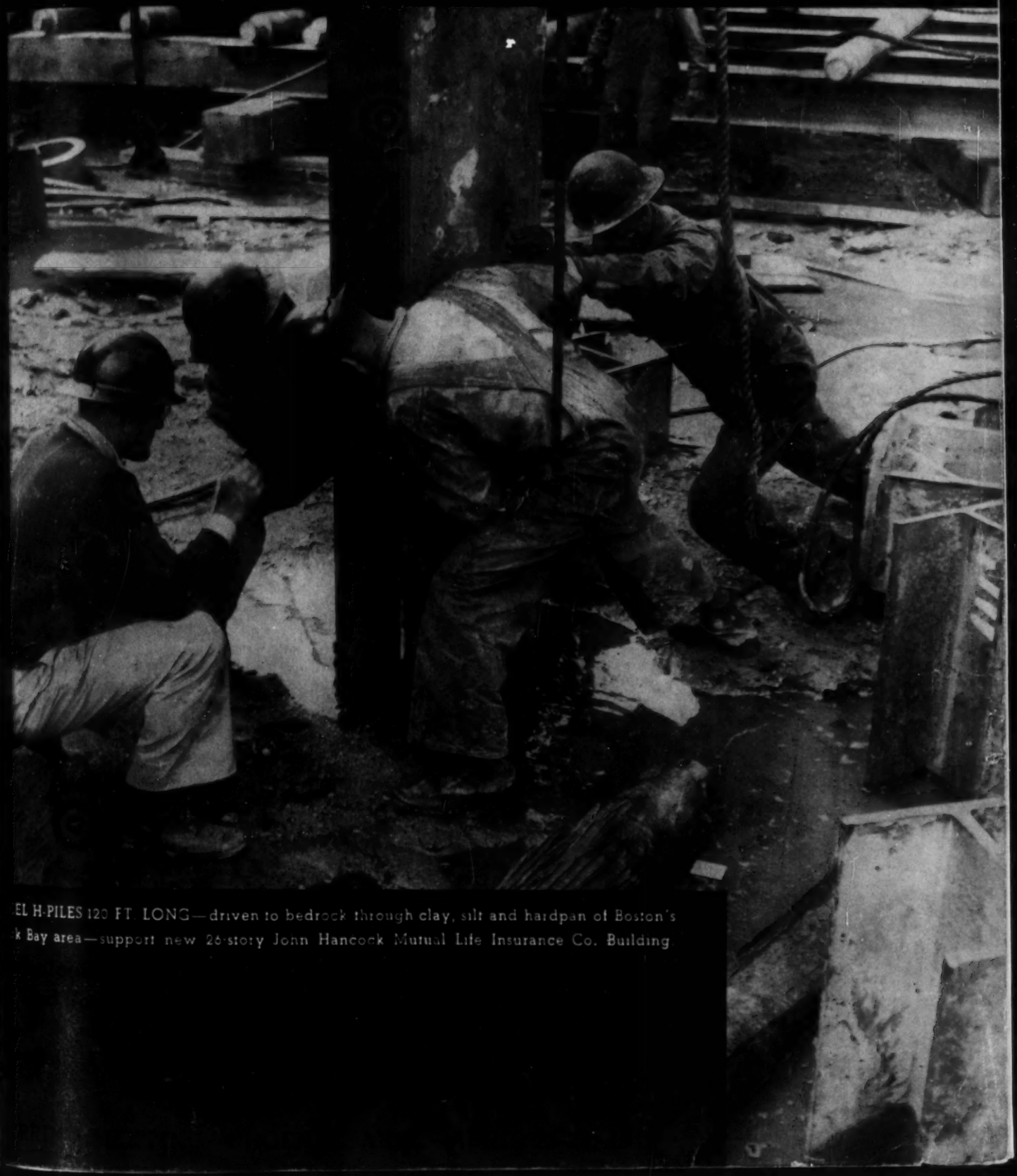
CIVIL ENGINEERING

MARCH 1947



EL H-PILES 120 FT LONG—driven to bedrock through clay, silt and hardpan of Boston's
k Bay area—support new 26-story John Hancock Mutual Life Insurance Co. Building

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MARCH 1947
Volume 17 Number 3

CIVIL ENGINEERING

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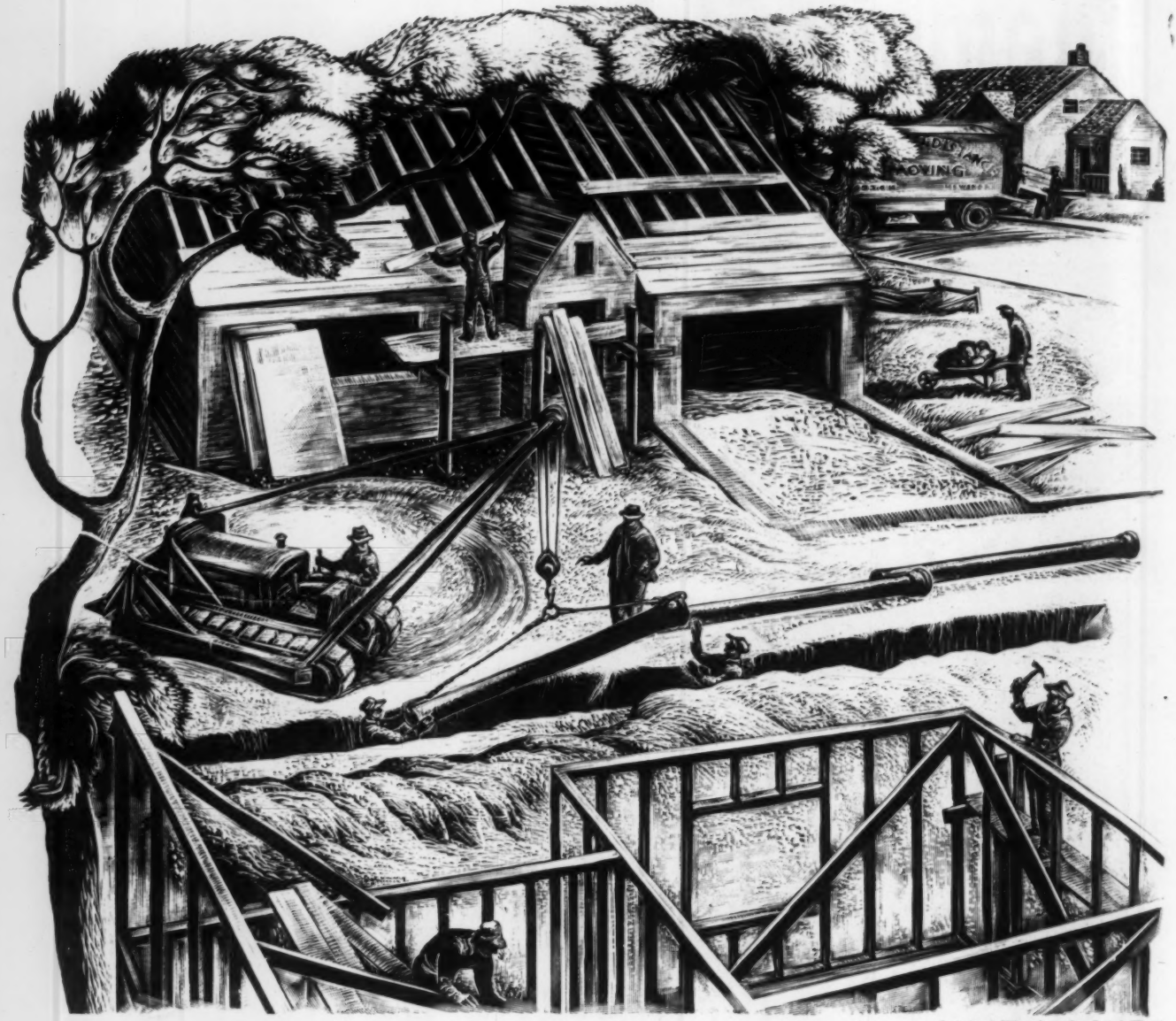

Original Woodcut by Lynd Ward

What a heartwarming thing it is for everybody—owner, neighbors, the whole nation—when the lights go on in a new house. Construction is improving, but there are still shortages of building materials and of the raw materials used in the manufacture of cast iron pipe for water, gas and sewerage services. Our five large plants are producing economical, long-lived U. S. Cast Iron Pipe and fittings to the maximum permitted by available raw materials. The outlook for increased production is favorable.

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AMERICAN SOCIETY OF CIVIL ENGINEERS

1947 SPRING MEETING

PHOENIX, ARIZONA APRIL 23 TO 25, 1947

Technical Sessions, Trips and Entertainment Feature Spring Meeting in Phoenix

IN THIS GUSTY MONTH of March—while a large part of our country is witnessing the evanescence of winter and its reluctance to surrender to spring—consider seriously the possibilities of visiting Phoenix, Ariz., where April typifies the true meaning of spring. Although a sharp March gale may serve as a reminder, and ideal climate (plus the Arizona desert in full bloom) may be a main attraction, there are many more good reasons to attend the Spring Meeting. Technical Division sessions scheduled for parts of two days, inspection trips to points of engineering and historical interest, and entertainment planned by a committee with imagination, ingenuity and a good sense of humor will make the three-day meeting an unforgettable event to those who are fortunate enough to be able to attend.

Entertainment Features

An elaborate program of entertainment for visiting members and ladies is being developed. On Wednesday evening, April 23, an entertainment typical of early Western days has been planned. On Thursday, April 24, there will be a buffet supper and dance at the Hotel Westward Ho.

On Friday, April 25, an all-day trip will be made to the Miami Copper Co. plant for an inspection of the open-pit mining operations and reduction plants. Following a barbecue luncheon, there will be a color movie of copper technology.

Entertainment for visiting ladies includes a bus trip on Wednesday, April 23, to a nearby winter resort for a Mexican Luncheon, followed by a visit to orange and date groves in the vicinity. On Thursday, April 24, the ladies will visit the Botanical Gardens where numerous species of cacti may be seen, followed by a luncheon with Indian entertainment. After luncheon, the group will visit Frank Lloyd Wright's "Taliesen West," the winter home and workshop of the Taliesen Fellowship in the field of desert architecture.

All entertainments and social affairs in connection with the Spring Meeting will be informal, and formal or dress clothing will not be required.

The climate will be mild in Phoenix at the time of the Spring Meeting so that light and medium-weight clothing will be in order.

Technical Sessions Planned

As is customary with Society meetings, the Phoenix meeting will open on Wednesday, April 23, 1947, with a general session in the forenoon followed by a luncheon for men. Technical Division sessions will occupy Wednesday afternoon and all day Thursday, April 24. The following is a summary of the Technical Division sessions:

WEDNESDAY AFTERNOON, APRIL 23

Highway Division

"Durability of Highway Substructure and Pavement"

DONALD J. STEELE, Assoc. M. ASCE, Public Roads Admin., San Francisco, Calif.

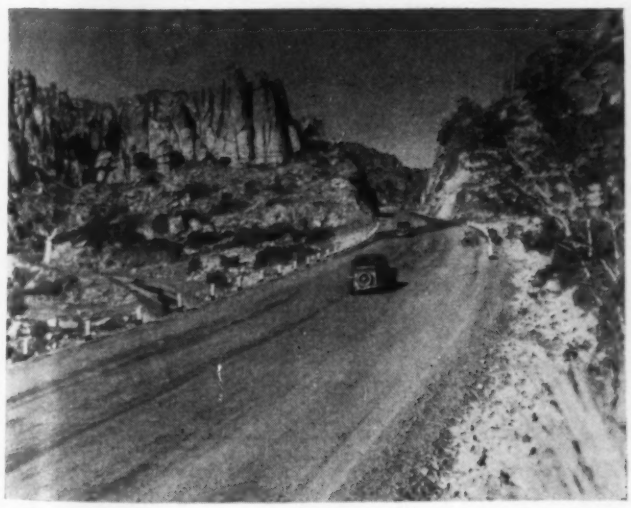
"Arizona Highway Problems"

EARLE V. MILLER, Assoc. M. ASCE, Chief, Division of Plans, State Highway Dept., Phoenix, Ariz.

"Freeways and Parkways"

LLOYD ALDRICH, M. ASCE, City Engineer, Bureau of Engineering, City Hall, Los Angeles, Calif.

ROUTE OF EXCURSION (below) to Miami Copper Mines, Friday, April 25, is along scenic Superior-Miami Highway. Jokake Inn is luncheon stop for ladies on Wednesday trip.



STANDARD METHOD of transportation during Spanish civilization, burrow and pack saddles, has not changed materially in 400 years. Kyac boxes—formerly made of leather—hold about 100 lb of ore.

Irrigation Division

"Utilization of Colorado River Water in Arizona"
CHARLES A. CARSON, Attorney, Cunningham and Carson, Phoenix, Ariz.

"Administrative Control of Groundwater and Its Economic Effect"
HAROLD CONKLING, M. ASCE, Consulting Engineer, Los Angeles, Calif.

"Pumping Plant Design for Colorado River Aqueduct"
JULIAN HINDS, M. ASCE, General Manager and Chief Engineer, Metropolitan Water District of Southern California, Los Angeles.

Surveying and Mapping Division

"Postwar Photogrammetry"
LEON T. ELIEL, Vice-President, Fairchild Aerial Surveys, Inc., Los Angeles, Calif.

"System of Plane Coordinates for Arizona"
COMDR. ROLAND D. HORNE, Assoc. M. ASCE, U.S. Coast and Geodetic Survey, Los Angeles.

THURSDAY MORNING, APRIL 24

Hydraulics Division

"Economic Effects of Sedimentation"
W. E. CORFITZEN, Assoc. M. ASCE, U.S. Bureau of Reclamation, Washington, D.C.

"Retrogression and Its Effect on the Colorado River after Construction of Boulder Dam"
J. W. STANLEY, River Control Office, Bureau of Reclamation, Boulder City, Nev.

"Sedimentation Investigations at Conchas Reservoir"
D. C. BONDURANT, Assoc. M. ASCE., U.S. Engineer Office, Albuquerque, N.Mex.

Construction Division

"Construction of Davis Dam"
L. R. DOUGLASS, M. ASCE, Assistant Regional Director, Region 3, Bureau of Reclamation, Boulder City, Nev.

"Construction of San Diego Aqueduct"
CAPT. ALDEN K. FOGG, Assoc. M. ASCE, Civil Engineer Corps, U.S. Navy, San Diego, Calif.

"Concrete Aggregate Reappraised: The Influence of Rock Properties"
R. F. BLANKS, M. ASCE, Chief, Engineering and Geological Control and Research, Bureau of Reclamation, Denver, Colo.

THURSDAY AFTERNOON, APRIL 24

Air Transport Division

"Factors in Airport Drainage"
E. H. KOEHM, Assoc. M. ASCE, U.S. Engineer Office, Los Angeles, Calif.

"The Engineer and the Airport"
R. W. F. ("BOB") SCHMIDT, Supt. of Airports, Civil Aeronautics Admin., Santa Monica, Calif.

"Air Traffic Control"
ARTHUR JOHNSON, Supt., Airways Operation Branch, Region VI, Civil Aeronautics Admin., Los Angeles.

Power Division

"Arizona Power Requirements"
MILTON G. SANDERS, Central Arizona Light and Power Co., Phoenix, Ariz.

"Colorado River Power Development—Past and Future"
HARVEY F. MCPHAIL, Branch of Power Utilization, Bureau of Reclamation, Washington, D.C.

Sanitary Engineering Division

"Some Effects of Anaerobic Digestion Upon Sewage Sludge"
A. M. RAWN, M. ASCE, Chief Engineer and General Manager, Los Angeles County Sanitation Districts, Los Angeles, Calif.

"Colorado River Water for Domestic and Irrigation Purposes"
G. E. ARNOLD, M. ASCE, Assistant City Manager, San Diego, Calif.

"Engineering in Public Health"
G. W. MARX, Assoc. M. ASCE, Director, Sanitary Engineering, State Dept. of Public Health, Phoenix, Ariz.

Post-Meeting Vacation Opportunities

Arizona offers a wide variety of interest for vacationists at the time of the Spring Meeting. For those who come to Phoenix by automobile, there is the Grand Canyon some 240 miles to the north, Miami Copper Co. mines and Roosevelt Dam to the east, and Tucson and Nogales to the south.

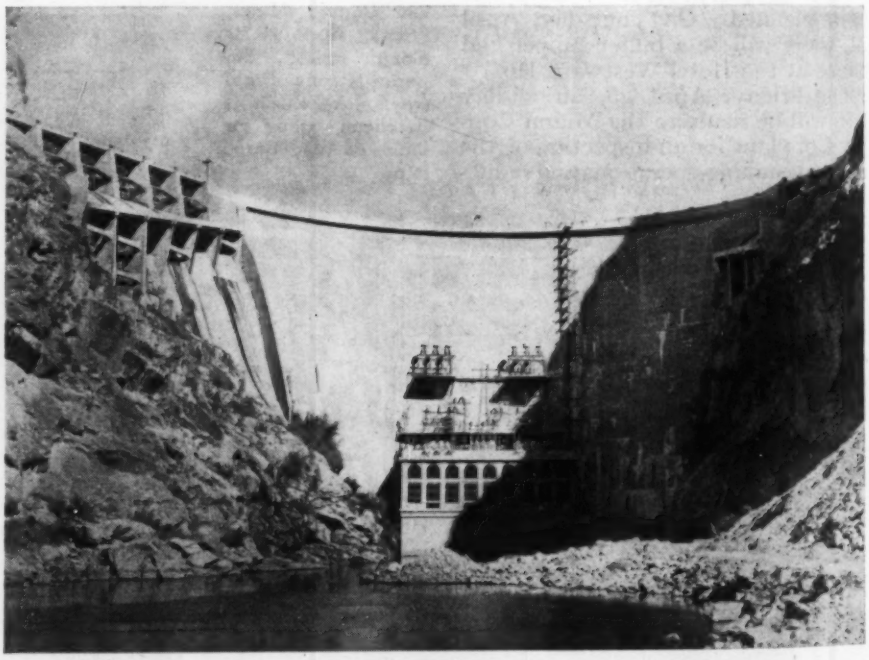
Shorter trips near Phoenix include the Reynolds Aluminum Co. Extension Plant; South Mountain Park, the largest municipal park in the world; and Mesa Mormon Temple.

Literature on vacation opportunities will be available at the meeting or will be sent to interested members who write the committee direct.

Hotel Reservations

The headquarters of the Spring Meeting will be the Hotel Westward Ho, which has reserved a block of rooms for visiting members. Requests for reservations should be made as early as possible.

Room reservations should be made by addressing request to Leigh O. Gardner, chairman, Hotel and Reservations Committee, 415 First National Bank Bldg., Phoenix



POST-MEETING VACATION opportunities are offered by many points of engineering and historical interest in Arizona, such as Horse Mesa Dam on Salt River, pictured here.

Welded Steel Piles Support 26-Story Skyscraper

IN BACK BAY AREA OF BOSTON

MODERN 26-STORY SKYSCRAPER, home of John Hancock Life Insurance Co., Boston, Mass., is supported on 1,637 steel H-piles driven to bedrock through clay, silt and hardpan. Building design is by Cram & Ferguson, Boston architects and engineers.

CONSTRUCTION OF A $15,000,000 addition to the home office building of the John Hancock Mutual Life Insurance Co. in Boston's Back Bay area posed extraordinary foundation problems. At a spot which a few centuries ago was part of the Atlantic Ocean, the 26-story building is supported on 120-ft steel piles extending through silt, clay fill, and hardpan to bedrock, 155 ft below the surface. Over an area of 62,500 sq ft, 1,637 such piles support a 10-ft reinforced concrete slab which serves as a foundation for the steel framework of the building. General contractor, in charge of construction of the new addition, is the Turner Construction Co., New York, N.Y. Pile-driving operations were sublet to the Raymond Concrete Pile Co., of Boston and New York.

The site for the modern skyscraper in the heart of the Back Bay area is approximately 19 ft above sea level. Down to El. 0 the area consists of man-made land—sand and gravel fill. The material from El. 0 to approximately El. −25 is organic silt overlying a hard layer of yellow and blue clay, approximately 10 ft thick, on which a majority of the structures in the Back Bay area are supported. Below the hard clay for a distance of 70 to 80 ft, there is a glacial deposit of soft blue clay overlying approximately 10 to 20 ft of hard sand, gravel, and hardpan. Bedrock under the hardpan runs from 128 ft below street level on Stuart Street to 160 ft on St. James Avenue. Eight standard earth borings were taken in this area and met refusal in the hardpan. Five core borings, drilled 20 ft into the rock, were made at the four corners and center of the job site.

To make way for the new addition, it was necessary to clear a 250-ft square site, an area bounded by St. James Avenue, Berkeley Street, Stuart Street, and by the existing 8-story building housing the John Hancock Boston office. This work involved removal of the old John Hancock Hall, a 72×100-ft auditorium with a foundation consisting of 31 concrete caissons extending to a maximum depth of 25 ft.

Floating Foundation Considered

Several types of foundations were considered for the support of the new building, among them the so-called "floating foundation," similar to that constructed for the New England Mutual Life Insurance Co. Building, in which a box-type basement is placed on the hard yellow or blue clay and consideration is given to the weight of excavation removed from the site and to the hydrostatic uplift of the groundwater. However this procedure was not considered practicable because of the excessive weight of the structure, estimated at approximately 140,000 tons.

Foundations to rock, such as compressed-air caissons, drilled-in caissons, 24-in. driven steel shells, and steel H-piles were also reviewed. The first three types were abandoned to eliminate the risk of disturbing the underlying soft blue clay to a point where settlement of surrounding structures might ensue. The use of H-pile sections was selected as the type of foundation that would cause a minimum amount of disturbance to the sub-clay stratas. Further, the H-pile section was estimated to be the most economical type of foundation, provided adequate lateral support was afforded by surrounding material.

Test Piles Driven

Two test piles—of 14-in., 73-lb. section—were installed on the building site. A No. 0 Vulcan single-action hammer, with a 7,500-lb ram, stroke of 42-in., and delivery of 26,250 ft-lb, was used. The first pile was driven approximately 126 ft below the street level, with a total number of 2,318 blows. The second pile, located within 15 ft of the first, was driven 129 ft below street level with a total number of 2,160 blows.

An individual load test was made on each pile, and satisfactory results were obtained up to 200 tons, the limit of the loading equipment. An elastic shortening of the pile as great as 0.89 in. was recorded under this load. When the load was removed, the top of the pile returned to its original elevation.

90-Ton Loading Permitted

On the basis of satisfactory tests on the 14-in., 73-lb H-pile sections, a value of 90 tons per pile was permitted by the Boston Building Department for the 14-in., 117-lb H-piles specified for the job.

The original eight-story John Hancock Building, occupying one-half of the block to the west of the proposed structure, rests on 10,000 wood piles driven through the silt formation into the hard clay strata below El. −25. To maintain stability of this structure during operations, consideration was given to the under-

BUILDING SITE is 250×250-ft plot in heart of Back Bay area approximately 19 ft above sea level. First stage of excavation to El. 0 involves removal of 50,000 cu yd of earth. Banks adjacent to street are at 1-on-1$^1/_2$ slope. Canopied "critics' corner" in foreground provides comfortable spot for sidewalk superintendents.

pinning of its easterly footings. However, should the east wall of the present John Hancock building be firmly supported, over a period of years natural recession of the surrounding area in Back Bay would cause undue stress adjacent to this support, causing considerable cracking of the exterior walls at this point.

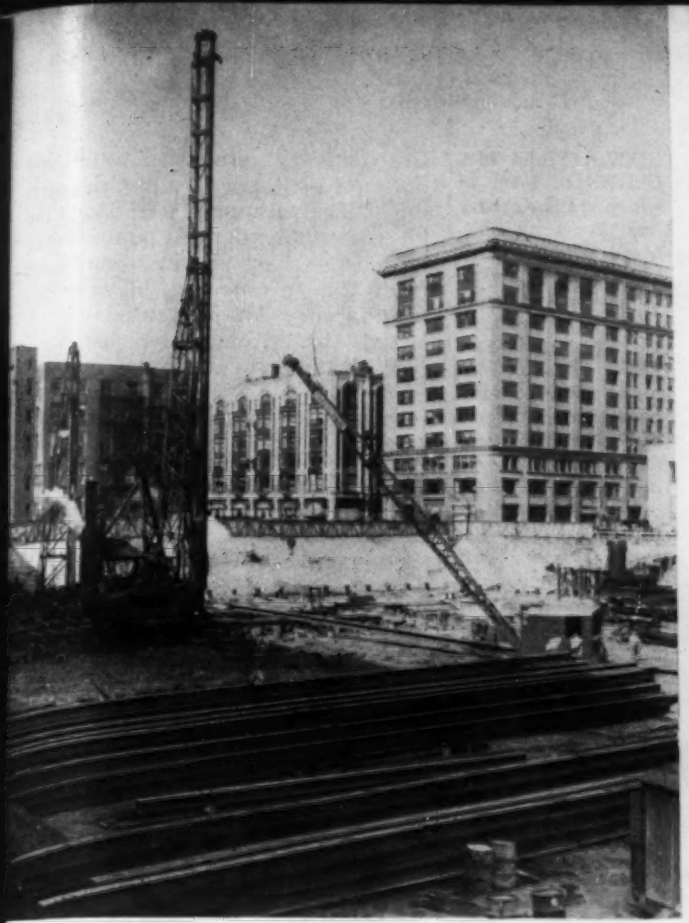
For the construction of the footings of the new building adjacent to the pile footings of the old structure, a method of design was developed that would restrain movement of the soft blue clay below the wood piles. Such restraint would serve the same purpose as rigid underpinning, and at the same time tend to permit uniform settlement of the old structure over a period of years without serious rupture. To overcome the tendency of the soft blue clay to move toward the excavation, 33-in., 200-lb WF beams were driven to rock on 7$^1/_2$-ft centers, with a cutoff at El. 0. These beams were later cut off at a lower grade to receive grillages. The same value of support was given to the 33-in., 200-lb beams as to the 14-in., 117-lb H-piles. Supplementing the thirty-three 33-in., 200-lb WF beams were one hundred and forty-four 14-in., 117-lb piles along the west wall of the new structure. The outside flange of the 33-in., 200-lb WF piles was driven flush with the exterior wall and was used to support the horizontal lagging, which was installed during excavation of the perimeter of the building.

Truck and Shovels Handle Excavation

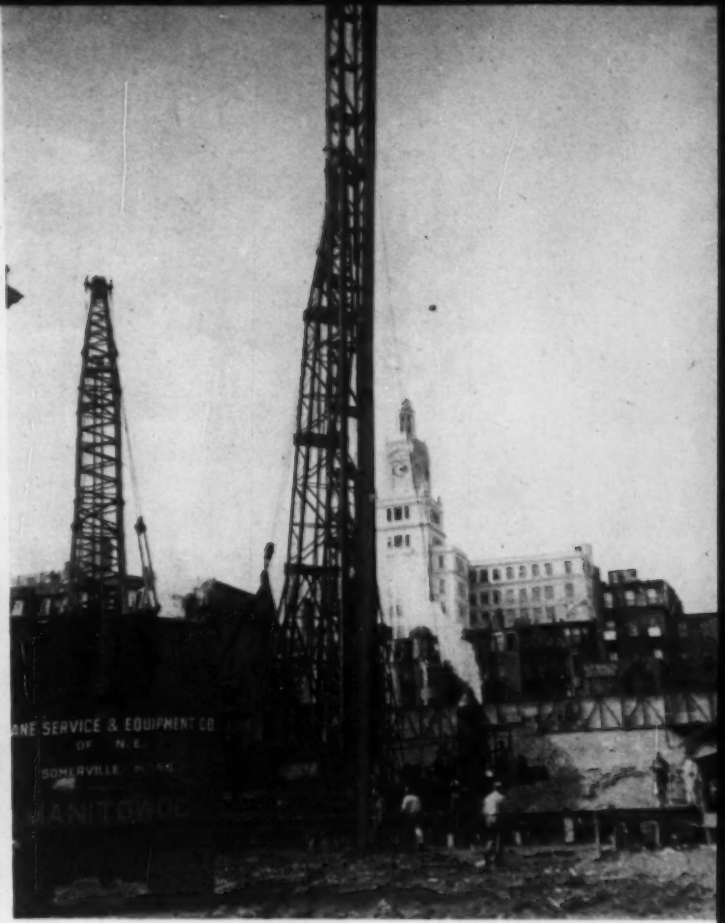
Excavation of the lot was made from the street grade of approximately +19 elevation to El. 0. The banks adjacent to the street were sloped from the curb line at an angle of repose of 1$^1/_2$ on 1. No restraining provisions were necessary adjacent to the existing building, as the tops of the foundations were at approximately zero elevation. The elevation of water before excavation was +5.87. Water was removed from the lot by the installation of three 18-in. perforated shells, sunk just outside the building line to the top of the silt. By pumping at these three locations and by the use of minor drainage ditches as the excavation progressed, a suitable dry condition was maintained for operating trucks and shovel equipment. To support the heavy pile-driving equipment, a foot or so of the man-made sand and gravel fill was allowed to remain over the silt foundation.

Pile driving was accomplished by the use of two rigs with leads of

STIFF-LEG DERRICK WITH 75-FT BOOM, anchored to concrete cap on wood-pile foundation, unloads 88- to 120-ft H-beams from trailer trucks on street. Special lifting device, 14-in. H-beam, 40 ft long, provides two points of suspension for handling long beams.



PILES ARE SUNK by Raymond Universal 117-ton driver, tallest of company's rigs, with tip 135 ft above ground. Driver has 70-ft boom and 128-ft steel fixed leads. Effective driving depth is 116 ft under Vulcan No. 0 hammer with ram increased from standard weight of 7,500 to 10,000 lb.



TWO PILE-DRIVING RIGS with leads of 128 ft and 120 ft are supplemented by standard rig which follows piles from El. 0 to El. −23.125. Twenty-ton crawler crane, with 60-ft boom, feeds piles to rigs when distance to stockpile is too great for picking up beams by pile driver.

128 ft and 120 ft. These rigs were supplemented by a standard pile-driving rig that followed the piles from El. 0 to the point of cutoff at −23.125. Two Vulcan hammers each with a 10,000-lb ram, developing 35,000 ft-lb, were used for completing driving operations; and a third Vulcan No. 0 hammer with 7,500-lb ram, developing 26,250 ft-lb, was used on the second large rig for sticking piles to El. 0. Piles were fed to the two driving rigs by the use of a 20-ton crawler crane. Piles, in pieces of 88 ft to 120 ft, were hauled to the site by trailer trucks that carried two or three piles at a time. The piles were unloaded by a stiff-leg derrick, shown in an accompanying photograph.

Although approximately one-third of the piles were rolled and received in single lengths, many were obtainable in half lengths only. Thus it was necessary to develop a yard for splicing the shorter lengths. Because of the lack of space at the job site, a receiving yard was set up in Charlestown, across the Charles River from Boston, where an overhead crane was available. Six welding racks were installed under this crane, with trundles to maintain alignment and revolve the piles as welding progressed. These trundles permitted all down welding, and allowed free rotation of the 120-ft piles. Piles were received on the siding on the opposite side of the crane area from the welding racks, and trucks for loading from the racks were backed into the center of the area.

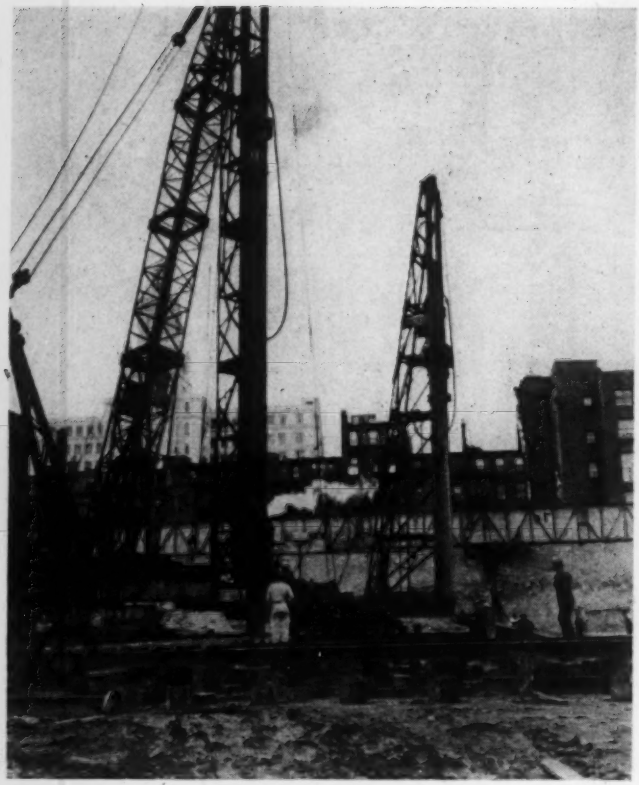
Pile cutoffs were established at a minimum of 2 ft 6 in. above the bottom of the concrete mat. This amount of penetration allowed the load to be transmitted to the pile through bond, as well as through end bearing. Any penetration into the mat over and above 2 ft 6 in. would tend to give a more conservative condition of the load transmitted. Piles were, therefore, ordered in accordance with information revealed by the five borings taken on the lot to El. −20. The additional length of approximately 3 ft was necessary to take care of contingencies arising from undulations in the rock surface.

Observe Movement of Hard Clay Strata

From experience in the construction of other foundations in the Back Bay area, it was noted that some upward movement of the hard clay strata had been encountered. Two observation points were therefore placed in the center of the building, 10 ft apart, by the use of Shelby tubes driven into the hard clay after a 3-in. casing had been sunk into the strata and washed clean. In addition to these two points, three other locations were also treated in a similar manner. Adjacent to these last three points, 14-in. piles were driven to rock prior to the final following of piles within a radius of 50 ft.

The two observation points in the middle of the lot indicated approximately a 0.5-in. rise at the time the lot was excavated to El. 0, prior to driving. The rise of the Shelby tubes at these two locations accelerated with the driving and increased in proportion to the number of piles driven over a period of several months. The total rise of the hard clay strata was 3 in., with approximately 50 percent of the piles completed. Although the hard clay strata adjacent to the completed test piles indicated a rise of $1^1/_4$ in., there appeared to be no tendency for the test piles to rise as a result of the driving of the piles within a radius of 50 ft.

To give full control and stability to the surrounding structures and streets, and in view of the tendency of the hard clay strata to move in



STEEL H-PILES ARE DRIVEN to level at which rig is working and then sunk additional 20 ft or more to bedrock by means of steel follower. Follower consists of 14-in. steel H-beam 25 ft long, with ¾-in. plates welded between flanges to form square section. Second stage of excavation to El. −25.625 is divided into approximately 100 segments. Concrete mat, 10 ft thick, is poured as each segment is excavated, imbedding 3½ to 5 ft of tops of piles.

an upward direction when the existing earth load is removed, the lot was excavated in approximately 100 segments. Each segment, from El. 0 to El. −25.625, was excavated and the 10-ft. concrete mat was poured on the clay surface before adjacent squares were uncovered. Excavation operations were carried on by means of backhoe and clamshell from El. 0, at which point the ground was sufficiently stable to support the equipment and trucks for hauling the material to the sump.

To control the water on the lot during the excavation operation, 8-in. perforated pipe, buried in gravel, was installed at the elevation of the top of the silt and sloped to two sumps at opposite corners of the lot. As silt tends to retain its water and does not give it up readily, dewatering of the overlying material kept the lot reasonably dry at points below its surface, provided groundwater from the surrounding fill was not introduced. The perforated pipe collected the groundwater before it reached the excavated area.

Piles and Lagging Support Banks

To maintain the banks from El. 0 to the bottom of the slab at El. −25.625, and to save cross-bracing of the entire lot, 12-in., 53-lb H-section piles were driven on 8-ft centers along Stuart and Berkeley Streets and St. James Avenue. These piles, 39 ft long, were driven 8 ft below the mat in the hard clay strata. Between the piles, and against the inside flange, 4-in.-thick horizontal Douglas fir lagging was inserted. This lagging supplemented the exterior form of the concrete wall. The edge of the concrete mat was kept approximately 30 ft from the outside of the exterior building wall to give a sufficient angle of repose to the bank adjacent to the three streets. Two shores of 12-in., 53-lb WF pile sections were installed between the upright pile and the concrete mat, permitting the excavation and concreting of the area around the perimeter of the building adjacent to the streets. This operation was taken in 20-ft sections, in order to maintain stability of the hard clay strata and have it exposed for the minimum amount of time.

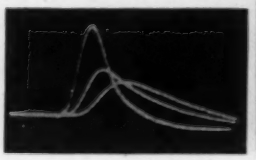
Electrical Computer Aids Flood Studies

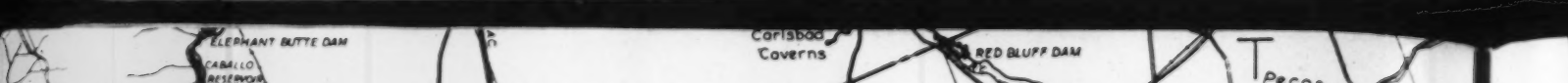
COMPLEX PROBLEMS OF CALCULATING flood movements in river systems are solved by an electrical computer recently designed and built under the direction of Prof. Claude E. Warren of the Ohio State University Department of Electrical Engineering.

"Flood conditions" comparable to those in a river are set up by introducing electrical current into the system and the movement of the flood crest down the "channel" can be observed and measured directly on an oscilloscope.

Under actual flood conditions, flood calculations become highly complicated because of the rapidly changing effects of rainfall, tributaries, dams and reservoirs, and channel variations. This newly developed electrical device—application of which was suggested by the U. S. Army Corps of Engineers—is expected to reduce the time and labor involved in making flood calculations to one-thousandth of that required by older methods.

ELECTRICAL COMPUTER (right) measures movement of flood crest down channel as indicated on oscilloscope (below).





International Treaty Authorizes Flood Control Structures on Lower Rio Grande

LAWRENCE M. LAWSON, HON. M. ASCE
United States Commissioner, International Boundary and Water Commission
and ING. RAFAEL FERNANDEZ MacGREGOR
Commissioner for Mexico, International Boundary and Water Commission

THE RECENTLY RATIFIED water treaty between the United States and Mexico is a striking example of constructive and preventive statesmanship on the part of both governments. It removes a long-standing threat to friendly relations between the two countries, and provides the means for the full development and use of the water resources of the Rio Grande and other border rivers to the benefit of both countries.

IN OCTOBER 1932, the U.S. and Mexican governments, recognizing the international character of the flood problem on the Rio Grande, entered into an agreement which provided a project contemplating the construction of flood control works by each country at its own expense in its own territory. This project is of the type that utilizes the river channel as far as possible, and consists of the river floodway defined by river levees, a main floodway which diverts water from the river on the United States side about 175 river miles above its mouth, and branch floodways which conduct waters from the main floodway to the Gulf.

Mexico, as her part of the international project, is constructing a similar system of levees and floodways on the southerly side of the river. The works are designed for a flood of 200,000 cfs in the Rio Grande at the Mission Inlet of the main floodway. The main floodway is designed to carry 120,000 cfs, discharging it into the North and Arroyo Colorado floodways near Mercedes, the North Floodway taking somewhat more than half of this flow.

Of the 80,000 cfs remaining in the river below the lower main floodway inlet, some 45,000 cfs will be carried to the Gulf by Mexican floodways Nos. 2 and 3, and the remainder will be carried by the river. The Rio Grande overflows its natural banks and reaches the levee at about 50,000 cfs near Mission and 30,000 cfs at Brownsville and Matamoros. From 1900 to 1940 twenty-five floods, varying in discharge from 60,000 to nearly 200,000 cfs, have passed Rio Grande City and Camargo, 50 river miles above the Mission Inlet.

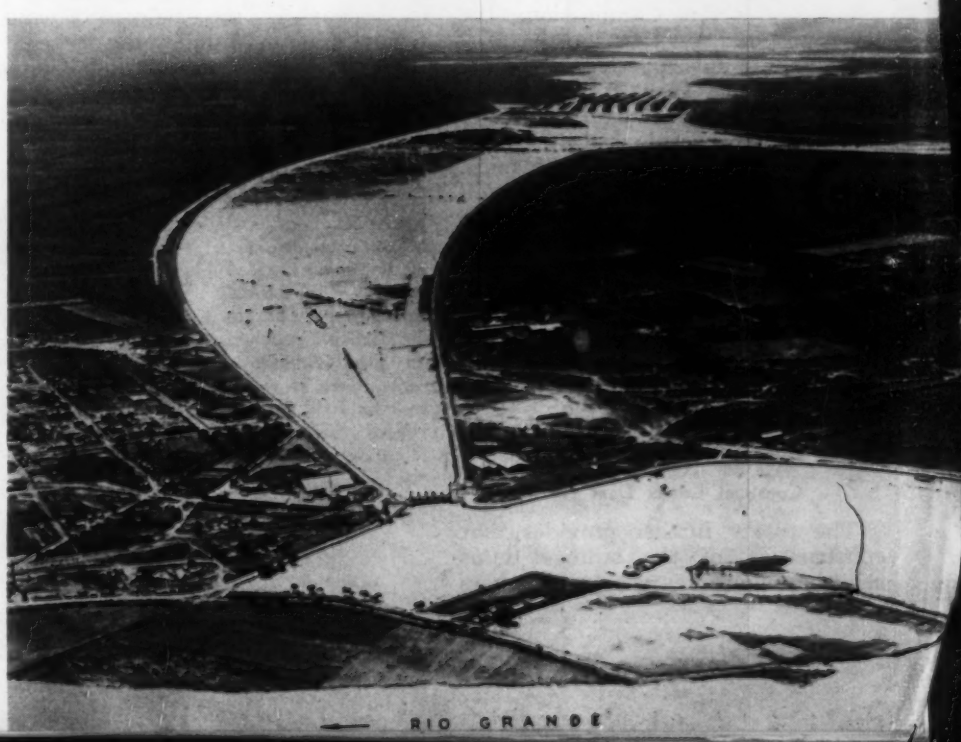
The earth levees of the system are compacted with sheepsfoot rollers, and the material, which is selected as far as possible, is rolled in the fill in horizontal layers with moisture content controlled, giving high density to the embankments and assuring their stability against long-continued high flood stages. Irrigation and drainage structures built through the levees are constructed of reinforced concrete and equipped with gate wells and cast-iron gates for control and durability.

Levees and flood channels are built with flat side slopes to minimize erosion by weather and floods over a long period of years. In short, all structures forming a part of the system are being built for permanency, to provide full security for the areas protected, to function efficiently in operation, and to require a minimum of maintenance.

New Dams to Be Constructed

In March of 1946, the engineers and consultants of the two sections of the Commission met in Mexico City to consider extensive data prepared by both sections and to formulate definite plans for investigations necessary before any actual construction work, authorized by the treaty, can be undertaken on the river. A number of specific recommendations were made with respect to studies and investigations that should be completed for the preparation of final plans, and some tentative decisions were reached regarding the Rio Grande International Dams Project.

This project contemplates the construction by the United States and Mexico of two or three multiple-purpose storage dams and their related features on the limitrophe reach of the Rio Grande. The reservoirs created by the dams will provide maximum feasible control and regulation of the river for irrigation and domestic water supply, flood reduction and control, hydroelectric-power generation, silt control, recreation, wild waterfowl protection, and re-



CONSTRUCTION OF FLOOD CONTROL WORKS by each country at its own expense in its own territory is provided in agreement between United States and Mexico made in October 1932. Shown here is view south across Rio Grande into Mexico showing east branch of floodway in flood. Rio Grande and floodway intake are in immediate foreground. Part of Matamoros, Tamaulipas, is seen at left.

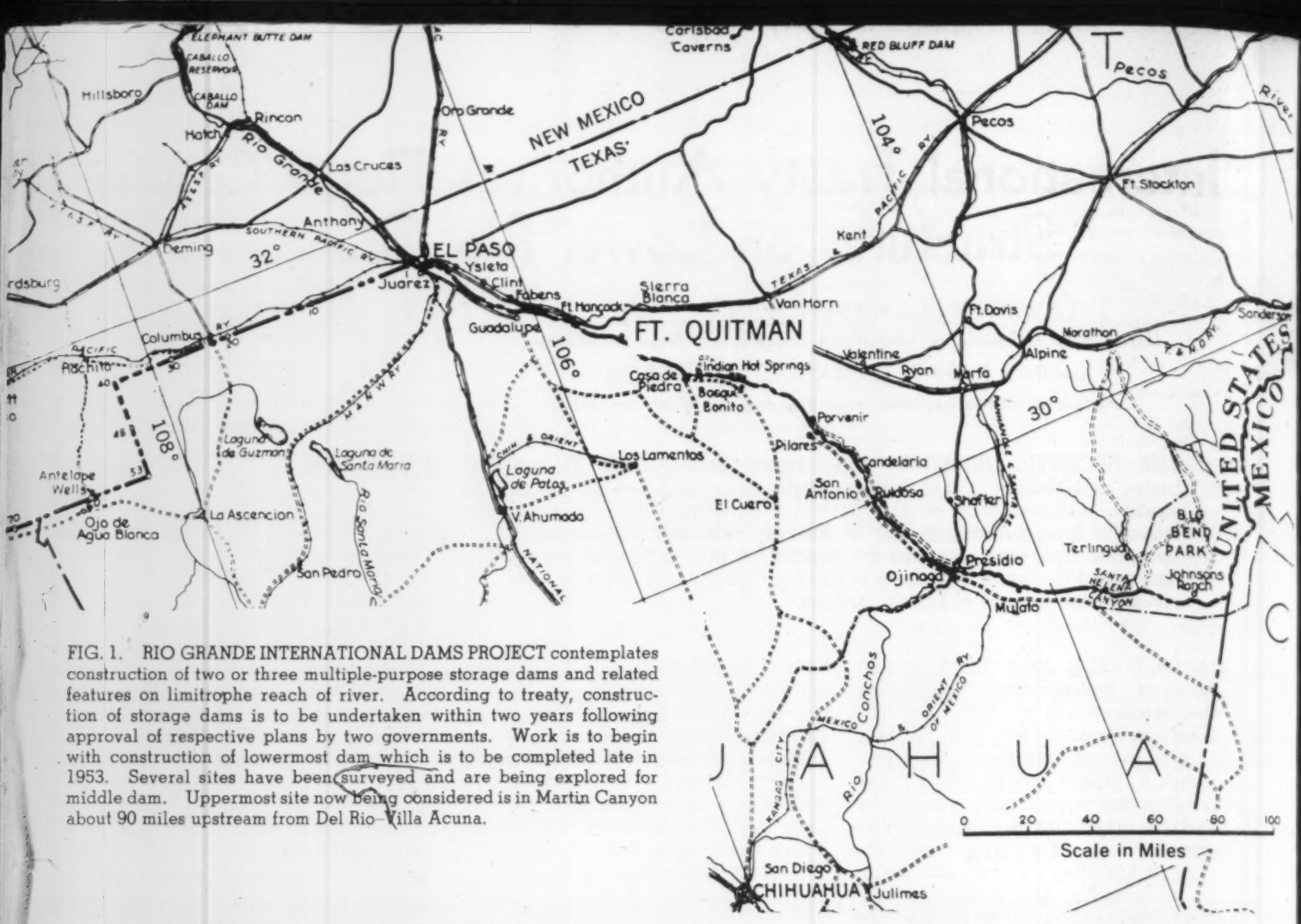


FIG. 1. RIO GRANDE INTERNATIONAL DAMS PROJECT contemplates construction of two or three multiple-purpose storage dams and related features on limitrophe reach of river. According to treaty, construction of storage dams is to be undertaken within two years following approval of respective plans by two governments. Work is to begin with construction of lowermost dam which is to be completed late in 1953. Several sites have been surveyed and are being explored for middle dam. Uppermost site now being considered is in Martin Canyon about 90 miles upstream from Del Rio–Villa Acuna.

lated purposes to the benefit of both countries. The treaty provides for the construction of three such storage dams in specified sections of the river, with the further provision that one or more of the stipulated dams may be omitted and others may be built—in either case, as may be determined by the International Boundary and Water Commission subject to the approval of the two governments.

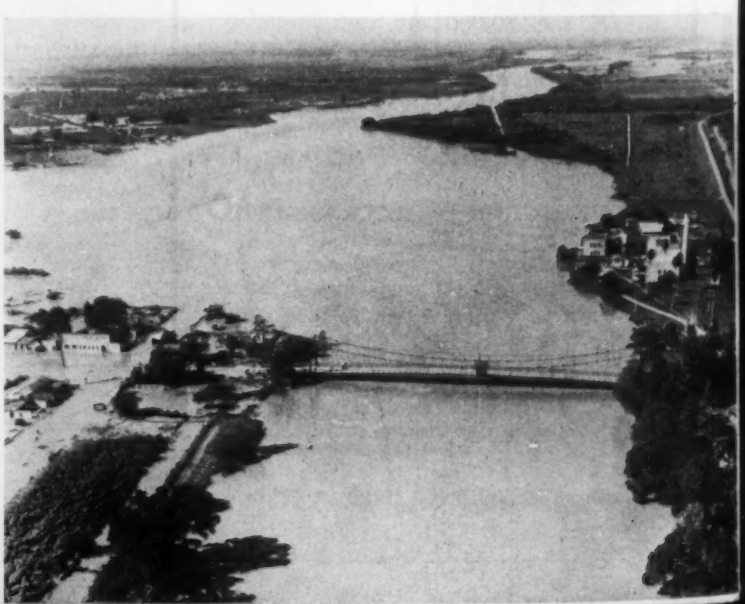
According to studies and plans developed by the Commission, the lowermost dam will be located at a site about 15 miles upstream from the towns of Roma, Texas and San Pedro de Roma, State of Tamaulipas. Subject to further geological tests and findings, the middle dam, if built, probably will be located at the Sullivan Springs site in the river reach between the cities of Eagle Pass–Piedras Negras and Laredo–Nuevo Laredo. Explorations are being carried on at the Agua Verde site in Martin Canyon about 90 miles upstream from Del Rio, Tex., and Villa Acuna, State of Coahuila, to determine its feasibility for the uppermost dam and reservoir.

Construct Lower Dam First

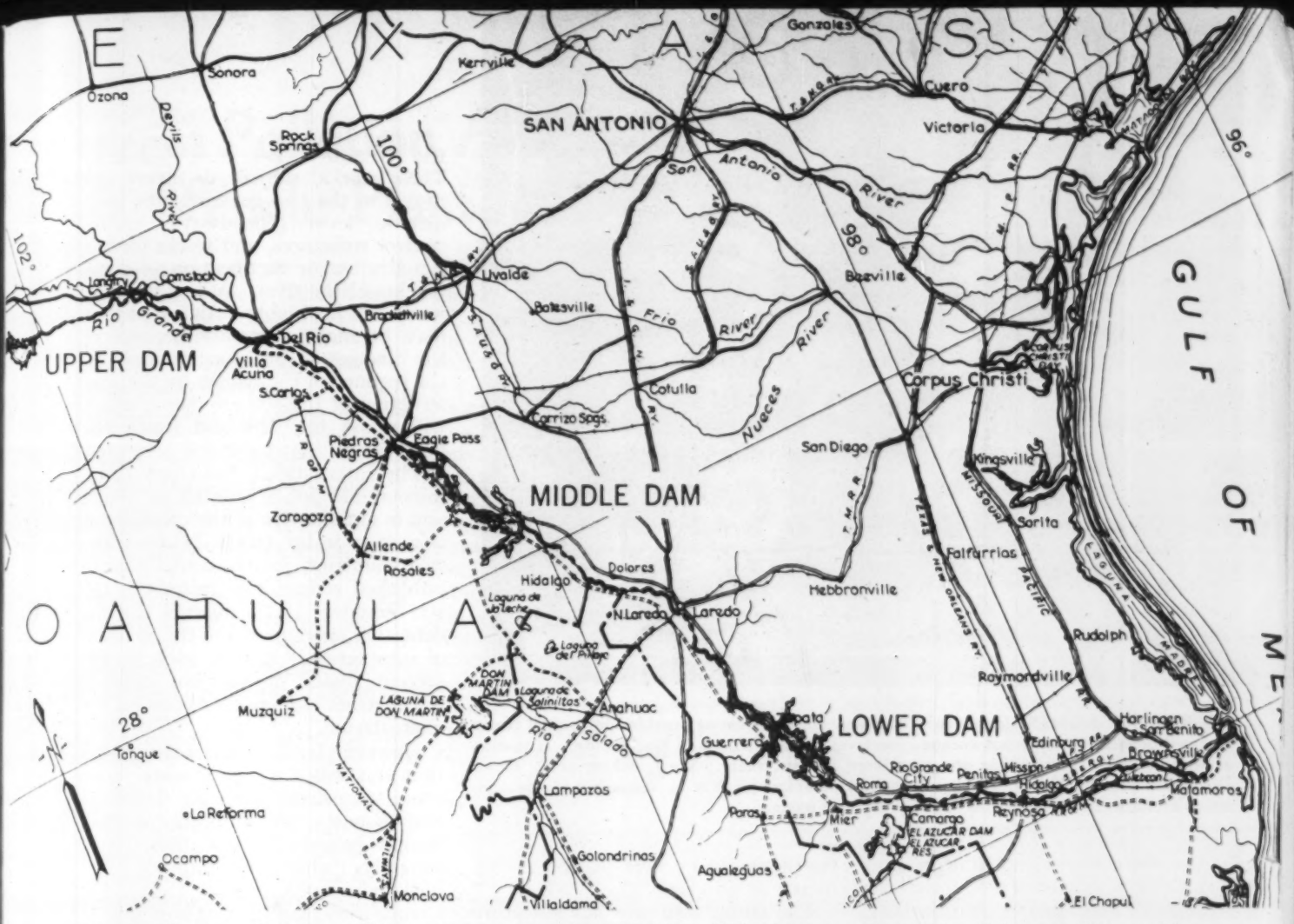
The treaty further provides that construction of the storage dams shall be undertaken within two years following the approval of the respective plans by the two governments, that work shall begin with the construction of the lowermost dam but that the upper dams may be started at the same time, and that the lowermost dam shall be completed within eight years from the date of entry into force of the treaty, that is by November 8, 1953.

Studies up to the present have established that the only adequate site for the lowermost dam is in what is known as the Falcon-Salineno region, about 75 miles downstream from the cities of Laredo and Nuevo Laredo. A rolled earth-fill structure is tentatively proposed, with a height above river bed of 150 ft and a crest length of about 19,700 ft, including a gravity concrete overflow spillway section about 625 ft in length located across the river channel. The reservoir would have a storage capacity of 3,150,000 acre-ft and a surface area of 93,540 acres when filled to flood-control level.

Topographic surveys have been made of the middle reservoir, and several dam sites have been surveyed and are being explored. It appears at this time that the Sullivan Springs dam site will be the most feasible. This site is about 50 miles downstream from Eagle Pass–Piedras Negras and 55 miles upstream from



FLOOD THREATENS DESTRUCTION of bridge anchorage at Mexican (south) end of International Bridge at Rio Rico. International character of flood problem on Rio Grande is recognized in water treaties between United States and Mexico.



Laredo–Nuevo Laredo. Present studies indicate that, if the dam is built, it should be a rolled earth-fill structure with a height above the river bed of about 150 ft and a crest length of about 16,800 ft, including tentatively a gravity concrete overflow spillway section about 800 ft in length located across the river channel. A dam of this height would create a reservoir having a storage capacity of 2,250,000 acre-ft and a water surface area of 65,350 acres.

Upper Dam to Be Concrete

The Agua Verde dam site, or the uppermost site now being considered, is in Martin Canyon about 90 miles upstream from Del Rio–Villa Acuna. Preliminary studies indicate that the dam, if built at this site, probably will be a gravity or arch-section concrete structure about 1,200 ft long on the crest, 200 ft long at river level, and about 420 ft high above the river bed. The reservoir created by such a dam would have a capacity of 4,500,000 acre-ft and a surface area of 42,300 acres.

Reservoir operation studies have been made on the basis of the runoff records for the 46-year period 1900–1945, projected for near future and ultimate conditions. These studies indicate that, during the early period, regulation provided by the Falcon Reservoir alone would provide an adequate water supply for the area of about 550,000 acres now irrigated in the two countries below the Falcon site, and would permit expansion to an area of slightly more than 1,000,000 acres, of which approximately 600,000 acres would be in the United States and 400,000 in Mexico.

Under these conditions, about 200,000,000 kwhr of firm energy could be generated per annum at the power plant with 50,000 kw of installed capacity. The flood-control capacity of the Falcon Reservoir would regulate the maximum flood expected to occur once in 100 years, to a flow of 50,000 cfs.

MEXICO IS CONSTRUCTING system of levees and floodways, similar to those on United States side of Rio Grande, as her part of international project based on agreement entered into October 1932. View shows point at which Rio Grande flows into Gulf.

Irrigation and Power

Operation studies indicate that after the uppermost dam and reservoir are constructed, and under ultimate conditions of development on the main stream and tributaries, the area irrigated on both sides of the river between Fort Quitman and the Falcon Reservoir can be increased to 160,000 acres, including the 28,000 acres now irrigated above the Agua Verde site, and that in addition a regulated water supply averaging 2,650,000 acre-ft per annum will be made available for the irrigation of lands in both countries below the Falcon Reservoir.

DEFINITIVE AGREEMENT for division of international waters as provided in present treaty makes it possible to construct storage reservoirs on main stream of Rio Grande. Irrigation as well as power possibilities are considered in new treaty. View, looking north, shows Lower Rio Grande Valley. Progreso District pumping plant is in immediate foreground; citrus orchards in United States are seen in right center.

The two reservoirs, Falcon and Agua Verde, operated jointly for irrigation and power production, would generate, under ultimate conditions of development, about 400,000,000 kwhr of firm energy per year and an average of 10,300,000 kwhr of secondary energy. The two reservoirs will control the maximum flood expected to occur once in a thousand years to an outflow at Falcon of 60,000 cfs.

Work incidental to the construction of the Falcon Dam will include the acquisition of the dam and reservoir site, the building of work camps and access and construction roads, and the replacement of the highways and utility lines interfered with outside of the reservoir area. This will involve the acquisition of approximately 105,000 acres of land about equally divided between the two countries, and various improvements.

About 37 miles of the paved road connecting Laredo and Brownsville, Tex., will have to be relocated and rebuilt outside the reservoir site. The treaty provides that each nation, at its own expense, shall acquire any private property located within its territory and needed for rights-of-way for the international dams project. Preliminary cost estimates indicate that the Falcon Dam and power plant will cost approximately $35,800,000. The cost of the upper and lower dams and power plants, including the transmission line between the two power plants, is estimated at $74,800,000.

The treaty also provides authority for the Commission to investigate and prepare plans for flood-control works when and where needed on the Rio Grande below Fort Quitman. These works, subject to future approval of the two governments, may include levees, floodways, grade-control structures, and works for the canalization or rectification of some reaches of the river. In this manner, works are justifiably anticipated that may be made necessary because of the changes to be brought about in the regimen of the stream by the construction of the storage dams, which will retain the silts and lessen the flood flows.

The International Boundary Commission has for a number of years, and in anticipation of the consummation of a water treaty between the two countries, jointly compiled and published stream-flow records of the Rio Grande. In the absence of some definitive agreement for the division of international waters, such as the present treaty, it was not possible to construct storage reservoirs on the main stream.

However, both countries recognized that this was the logical method for conserving flood flows for irrigation and domestic use in both countries during periods of low flow. Fortunately, when negotiations were initiated on the present treaty, the Commission had a vast amount of correlated, agreed-upon records and data covering a long period of years, on which to base treaty allocations.

$4,000,000 Princeton Library Scheduled for Completion in 1948

PRINCETON UNIVERSITY'S $4,000,000 Harvey S. Firestone Memorial Library, scheduled for completion in June 1948, will be one of the world's unique educational structures, a functional building planned from the inside out to implement Princeton's Plan of Independent Study.

Designed by the New York architectural firm of Robert B. O'Connor and Walter H. Kilham, Jr., and being built by the Turner Construction Co., the building will comprise a total mass of some 3,870,000 cu ft and will have a book capacity of 1,800,000 volumes, with seating accommodations for about 1,875 students.

Stream Pollution Abatement Program Proposes Single Plant for 100 Municipalities

Huge Task Faces Allegheny County Sanitary Authority in Complying with State's Directive Affecting Participating Municipalities and Industries.

JOHN F. LABOON, M. ASCE

Chairman, Allegheny County Sanitary Authority, Pittsburgh, Pa.

WITH ADOPTION OF THE SLOGAN, "Cleaner streams—better living," the Allegheny County Sanitary Authority, less than a year old, is heading for the goal set by the State of Pennsylvania regarding the abatement of stream pollution. Successful strides toward fulfillment of the states' requirements have already been made.

Of the 127 communities in the county, 102 have been ordered to cease discharging sewage and industrial wastes into the streams of the commonwealth, and 86 of these are participating in the Sanitary Authority's program by agreement. Of the remainder, 12 are committed to the program by initial legislative action. The two municipalities of New Kensington and Arnold, located outside of Allegheny County, have passed the necessary legislation to participate in the Authority's program, and are awaiting a revision of the Authority charter to permit the execution of agreements. Twenty-seven industries, out of 90 ordered, are doing likewise. These represent only those industries which discharge their sewage and industrial wastes into the streams directly, and do not represent the 2,000 or more industries which are connected up to the municipal sewerage systems of metropolitan Allegheny County.

The participants under agreement represent 90 percent of the total population of the area affected by the orders of the state, so that the work of the Sanitary Authority will be truly representative of a metropolitan plan of action.

The rivers of our community, now open sewers, will be cleaned up as soon as construction of a system of collecting sewers and a treatment works has been completed. Although this very desirable goal is still some years distant, we are on the way, and millions of persons who have been accustomed to seeing dirty and polluted rivers from their youth will learn to enjoy the clean streams and the better living that is coming to them and their children.

While the state at present demands only a 35 percent treatment of sewage and industrial wastes, 100 percent removal of polluting matter to be handled by the Authority can be achieved in the Pittsburgh harbor by the construction of a single treatment plant, to be located on the Ohio River below Pittsburgh. This will require the construction of almost

(*Continued on page 71*)

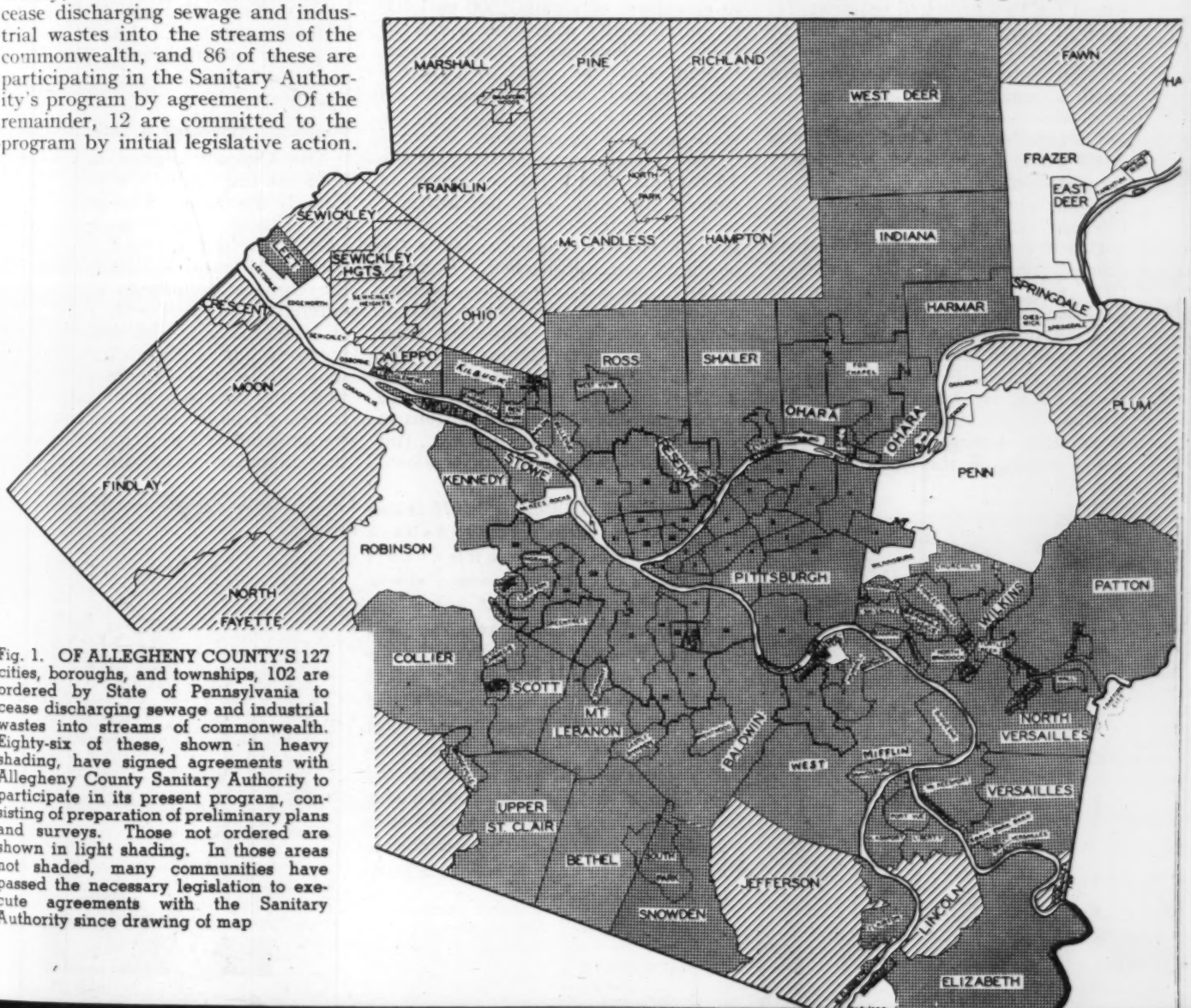


Fig. 1. OF ALLEGHENY COUNTY'S 127 cities, boroughs, and townships, 102 are ordered by State of Pennsylvania to cease discharging sewage and industrial wastes into streams of commonwealth. Eighty-six of these, shown in heavy shading, have signed agreements with Allegheny County Sanitary Authority to participate in its present program, consisting of preparation of preliminary plans and surveys. Those not ordered are shown in light shading. In those areas not shaded, many communities have passed the necessary legislation to execute agreements with the Sanitary Authority since drawing of map

Snoqualmie Tunnel Plan Provides Low-Level Route Through Cascade Mountains

OLE SINGSTAD, M. ASCE
Consulting Engineer, New York, N. Y.

ON THE BASIS OF STUDIES made to determine the feasibility of constructing a low-level tunnel with low-gradient approaches through the Cascade Mountains of Washington, the following report recommends a project which includes construction of a 2.03-mile-long tunnel near Snoqualmie Pass at an estimated cost of $21,940,000. An alternate project, which includes a 2.54-mile tunnel near Stampede Pass, was also considered, but on the basis of cost ($26,420,000) is recommended for some future date in favor of the urgently needed Snoqualmie route. Governor Mon C. Wallgren of Washington has submitted the original report, from which these excerpts were taken, to the state legislature and recommended its early consideration and an appropriation of initial funds.

A SUGGESTED PLAN of 37 years ago for building a 32-mile tunnel through the Cascade Mountains at the 1,000-ft level for both railroad and highway traffic may be, in part at least, responsible for the erroneous impression extant that such a plan should be effected. The idea is unsound for two principal reasons: (1) Such a long tunnel would not be economically feasible; (2) there is no considerable trouble with snow until a much higher elevation is reached.

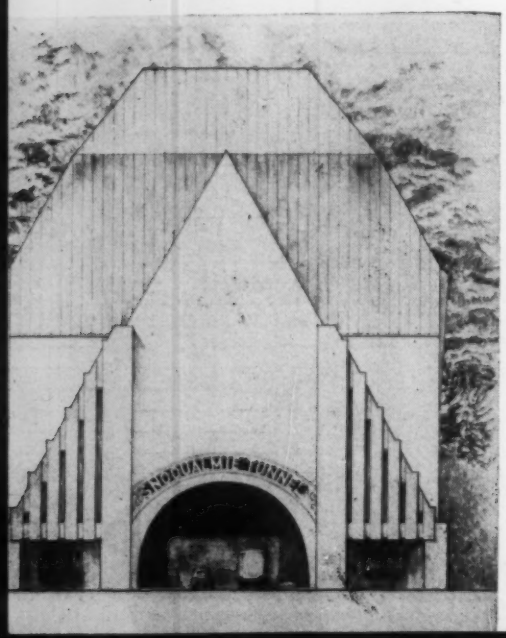
During March, April and May 1946, which happened to be a heavy snow season, the writer, accompanied by engineers, superintendents and foremen of the state highway department's maintenance forces, spent much time traveling the highways that were open to traffic in the Cascade and Wenatchee Mountains. In this manner first-hand information was obtained from the men directly responsible for keeping the roads open, on where and why the trouble occurs that causes interruptions and slowing down of traffic. As a result of this survey and a study (extending over a period of nine months) of the available records and of the terrain, the writer is convinced that—except for unusual cases such as Tumwater Canyon on primary state highway No. 15 (Fig. 1), where on account of the steep slopes of the canyon, serious slides can occur at elevations of about 1,200 to 1,400 ft—no difficulty with snow will occur below an elevation of 2,000 ft that cannot easily be coped with by the well-organized, well-equipped and experienced maintenance forces of the state highway department.

In the main range of the Cascade Mountains the depth of snow in general increases with the altitude, as do the factors creating snow slides, and the slopes become steeper as the summits are approached. If there is any one contour that is more significant than any other and at which a tunnel to eliminate snow trouble and interruptions to traffic should be located, it is at or near the 2,500-ft level. Subject to some variations due to local conditions of topography, grades, curves, etc., this in general is the approximate elevation at which it becomes desirable to get under cover to be free from winter interruptions.

There are very few places in the main range of the Cascade Mountains where it is possible to locate a vehicular tunnel even at this elevation without the tunnel's being so long that it becomes economically impractical. It is a fortunate circumstance, however, that the lowest part of the Cascade Range is almost in a direct easterly line with the two great cities on Puget Sound, Seattle and Tacoma. The survey and studies made indicate that there are two places, and two places only, in the Cascade Mountains of Washington where it is economically feasible at present, or at any foreseeable future time, to provide by means of a tunnel an east-west all-winter commercial highway route free from the hazards of winter interruptions. These two places are near Snoqualmie Pass and near Stampede Pass.

Wenatchee Mountains in Different Climate

The Cascade Range has several branches running in a general southeasterly direction. The most important of these spurs, so far as the east-west traffic is concerned, is the Wenatchee Mountains. Here, however, the climatic conditions are entirely different from those in the main range of the Cascade Mountains. The precipitation is much less and the snowfall is not of a magnitude to cause any serious hindrance to winter travel. This is best illustrated by the snowfall and winter conditions on the highway over Blewett Pass.



SNOQUALMIE TUNNEL is 10,676 ft long and on tangent alinement except for length of 487 ft at west end, where it is on curve with radius of 1,325 ft. Roadway at west portal (left) is at El. 2,239.5 and at east portal (right), at El. 2,635. Prevailing grade of tunnel roadway is 3 percent. Cascade Mountains summit of route is in tunnel at El. 2,636. Ventilation equipment is housed in buildings at each portal and in building at central ventilating shaft. Shaft is approximately 5,660 ft from west portal and 5,016 ft from east portal, about 850 ft deep and of circular cross section of 35-ft inside diameter. Top 50 ft of shaft is flared out to connect with air ducts in ventilation building above.

This road is far from being a satisfactory commercial highway but this is because of excessive curvature and prohibitive grades on the mountain crossing rather than heavy snowfall.

During the winter of 1945–1946, the total snowfall at Blewett Pass summit, El. 4,071, was only 184 in., while at Stevens Pass, 10 ft lower in elevation, it was 483 in., and at Snoqualmie Pass, 1,061 ft lower, it was 412 in. From this and other records and observations, it is clear that the snowfall on the Blewett Pass summit is less than one-half of the snowfall on the passes of the main range of the Cascade Mountains and corresponds to the snowfall at an elevation of less than 2,500 ft on the western slopes of the main Cascade Range. The writer's own observation, confirmed by the state highway department engineers, is that snow is not a serious obstacle to winter travel over the Wenatchee Mountains at elevations of about 4,100 ft, provided the highway is properly located.

The Stevens Pass route has been studied in detail in an effort to find a feasible solution whereby an all-winter commercial highway immune to interruptions by snow can be created by means of a tunnel through the Cascades. These studies and investigations led to the conclusion that it is not economically feasible to create such a highway at this location now or at any foreseeable future time. The cost of construction and operation would be entirely out of line with any benefits that could be derived from it.

LONGEST VEHICULAR TUNNEL

Snoqualmie Tunnel, 2.03 miles long between portals, will be longer than any existing vehicular tunnel anywhere, exceeding in length the Mersey River Tunnel at Liverpool, England, by 0.03 mile and the longest vehicular tunnel in operation in the United States, the Holland Tunnel under the Hudson River at New York, by 0.41 mile.

Some Stevens Pass tunnel advocates have suggested that the abandoned Great Northern Railway tunnel be taken over by the state and converted into a highway tunnel. This tunnel was abandoned by the railroad company because it is located at too high an elevation, where the snowfall is exceedingly heavy, and the western slope from the tunnel portal to the vicinity of Scenic contains a large number of hazardous snow-slide areas—even worse than the present highway route. This tunnel cannot be fitted into the state highway system.

Stampede and Snoqualmie Routes

At Stampede there is no well-defined pass through which a surface highway can cross the top of the mountain, such as at Snoqualmie. The present trail, very steep and winding, passes the summit at El. 3,750, or 746 ft higher than Snoqualmie Pass. The Green River–Stampede route, however, is in one important respect a good location for a Cascade Mountains highway crossing by tunnel. The highway on this route would be located in the heavy-snow region a shorter distance than would be possible on any other route across the Cascade Mountains and it would have as low gradient approaches as any other route.

There are, however, important practical existing conditions to be considered in selecting the first vehicular tunnel crossing of the Cascade Mountains.

The Snoqualmie route has the following advantages:

1. It permits the building of the shortest and therefore the cheapest tunnel, its length being 2.03 miles, while the Stampede tunnel would be 2.54 miles long.
2. It has an existing primary state highway which, except for 9 miles immediately adjoining the present summit, can, when improved, be advantageously used as an approach highway on the east and on the west. This highway, and the north-south primary state highway No. 1 from Vancouver on the Columbia River to the Canadian border, constitute the only two highways in the state designated by the federal authorities as regional highways.
3. It is a direct route to and from the greatest single population center in the entire state, the City of Seattle and the surrounding suburbs, as well as the area on the northern part of Puget Sound.
4. It can be conveniently connected to the second largest population center in Washington, the City of Tacoma and tributary areas, including the area served by the proposed Narrows Bridge.
5. The Snoqualmie route has the west portal of the tunnel located at an eleva-

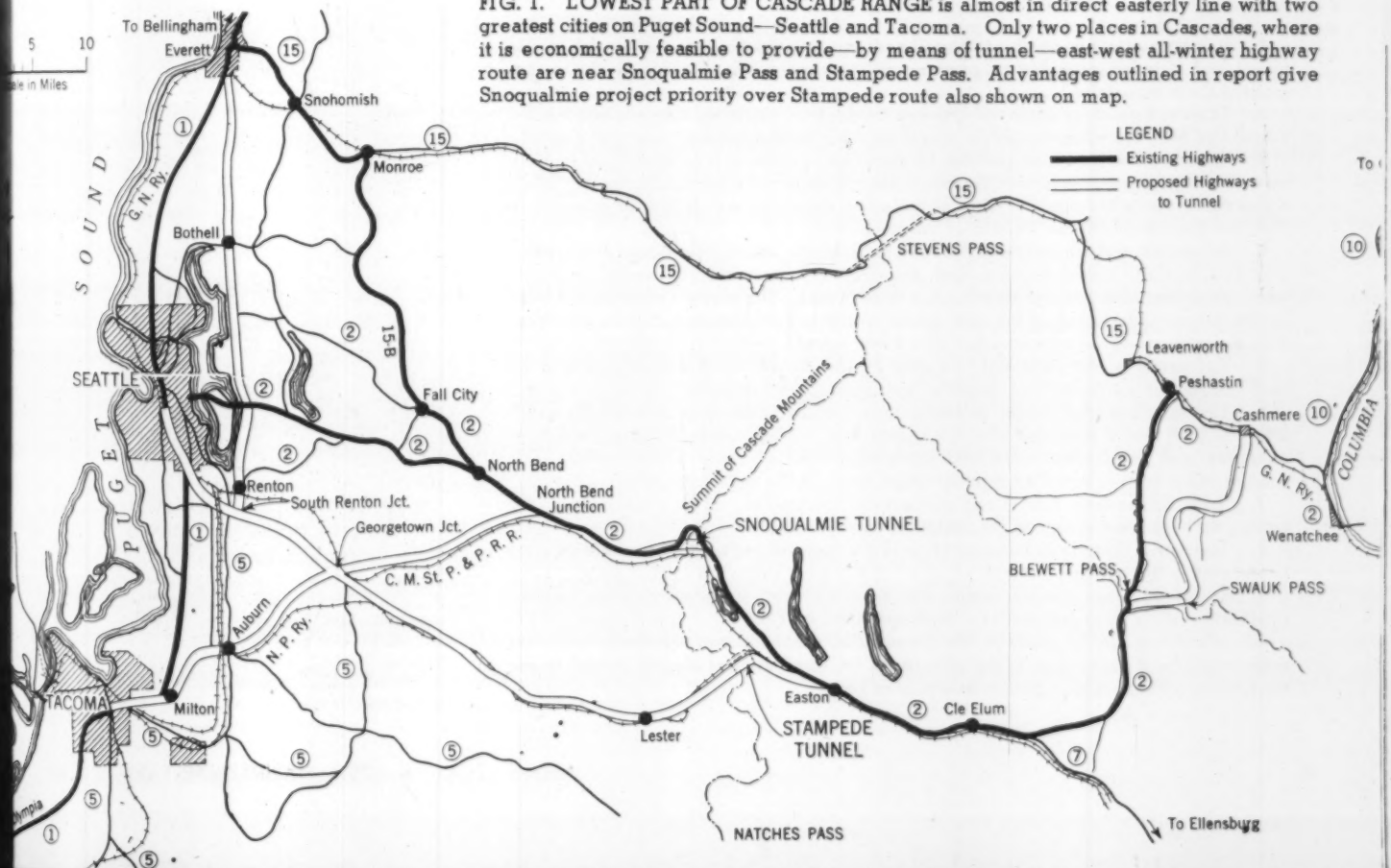


FIG. 1. LOWEST PART OF CASCADE RANGE is almost in direct easterly line with two greatest cities on Puget Sound—Seattle and Tacoma. Only two places in Cascades, where it is economically feasible to provide—by means of tunnel—east-west all-winter highway route are near Snoqualmie Pass and Stampede Pass. Advantages outlined in report give Snoqualmie project priority over Stampede route also shown on map.

tion of 2,330 ft, or 335 ft lower than would be practicable at Stampede, and the summit is 55 ft lower than on the Stampede tunnel route.

6. It would come nearer being a self-liquidating toll project than the Stampede tunnel route, which would have a more expensive tunnel, and if built at this time as a toll project would be in competition with the existing free route across Snoqualmie Summit.

Little Difference in Grades

In comparing the Stampede and Snoqualmie crossings of the Cascade Mountains with reference to truck traffic, practically all of which would be routed through Georgetown Junction, there is very little difference in the prevailing grades and total lift. The distance between the two common points, Georgetown Junction and Easton is only 2.8 miles shorter by way of Stampede than by the Snoqualmie route. The only other advantage in favor of the Stampede route is that the approach highway from Easton to the east portal of the Stampede tunnel is about $8^1/_2$ miles shorter than the distance from Easton to the east portal of the Snoqualmie tunnel.

Both of these routes are at an elevation at which rotary snow ploughs have to be used to keep the roads open in the winter. It is believed, however, that the advantages of distance in favor of the Stampede route, are more than offset by other factors which are in favor of the Snoqualmie route, some of which have already been stated. The amount of investment by the state for a tunnel and connecting highway at Stampede would be slightly higher than at Snoqualmie.

The Stampede tunnel, if built first and operated as a toll project, would be in competition with an existing free route over Snoqualmie Pass, and the amount of money that could be amortized on a toll project at Stampede would be considerably less than at Snoqualmie. The state would have to pay the operation and maintenance costs of maintaining two highways across the mountains, while for a number of years the volume of traffic could be adequately served by one such crossing.

The Snoqualmie route would serve more directly Issaqua and vicinity and the territory tributary to the present primary state highway No. 15-B, covering generally the North Bend, Fall City, Duval and Monroe area, than would be the case with the Stampede crossing. The passenger-car traffic from Seattle, which would constitute a large part of the traffic crossing the mountains, would save 4.1 miles in distance between Seattle and Easton as compared to the Stampede route.

When all pertinent factors are considered, it is believed that it would be in the best interest of the state to build the first tunnel at Snoqualmie.

SNOQUALMIE TUNNEL ROUTE shortens 9-mile stretch of present highway by more than $2^1/_2$ miles and eliminates causes of traffic interruptions by removing highway from mountainside, where snow slides occur, to slide-free opposite side of river. Curvature of new approach roads is reduced and grades are reduced to maximum of 3 percent.

Cost of Snow Removal

The winter season of 1945–1946 is generally reputed to have been a heavy snow season, although the recorded snowfall at Snoqualmie Pass of 412 in. for that season is very close to the average annual snowfall of 411.6 in. recorded by the state highway department over a period of 37 years.

During the 1945–1946 winter season the cost of snow removal on primary state highway No. 2 was as follows:

Upper crossing, Snoqualmie River to Hyak	$65,906.65
Hyak to Easton	$20,000.00
Upper crossing, Snoqualmie River to North Bend	$15,000.00
Total	$100,906.65

SUMMARY OF CONCLUSIONS

1. It is impractical to combine the railroads crossing the Cascade Mountains in one tunnel and it is impracticable to combine railroad and highway traffic in one tunnel crossing these mountains.
2. There is a need for improved highway connections across the Cascade Mountains; a road free from the winter hazards of travel can be provided only by means of a tunnel.
3. There are two locations, and two locations only, where it is economically feasible now or at any foreseeable time in the future, to provide an all-winter commercial highway across the Cascade Mountains. One of these locations is in the vicinity of Snoqualmie Pass and the other is in the vicinity of Stampede Pass.
4. It is to the best advantage of the state to build the Snoqualmie tunnel first, starting with one two-lane tunnel initially, with the necessary connecting highways, and later when warranted, building a companion two-lane tunnel. The mountain crossing, except for the tunnel and viaduct at the west portal of the tunnel, should be made four lanes wide simultaneously with the building of the first tunnel.
5. The needs of the state will probably eventually require that another tunnel be built, located at Stampede Pass, together with connecting highways.
6. The recommended initial two-lane tunnel at Snoqualmie is estimated to cost $21,940,000, and if operated as a toll tunnel, will provide revenues sufficient to pay operating and maintenance costs and liquidate a loan of about $17,000,000. This amount of the loan is based on earnings which would make the bonds readily salable.
7. If the Snoqualmie Tunnel and connecting highways are made a toll project, the entire cost of the tunnel can be liquidated by the revenues.
8. The tunnel route is an important link in the regional highway system and of great importance in the national defense.
9. The Snoqualmie Tunnel, which will be 2.03 miles long, presents no unusual construction difficulties and can be completed in three years.
10. Provision can be made in the tunnels for telephone and telegraph lines, but there would be no advantage to the state, or to the distributors of electric power, to use the tunnels for high-tension power transmission lines.

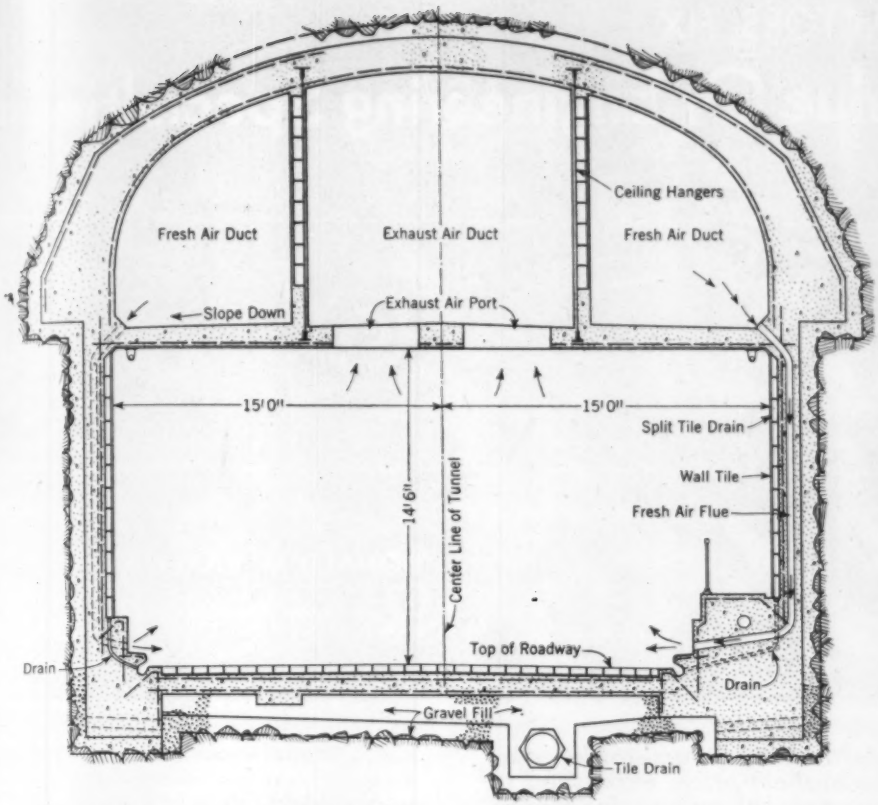
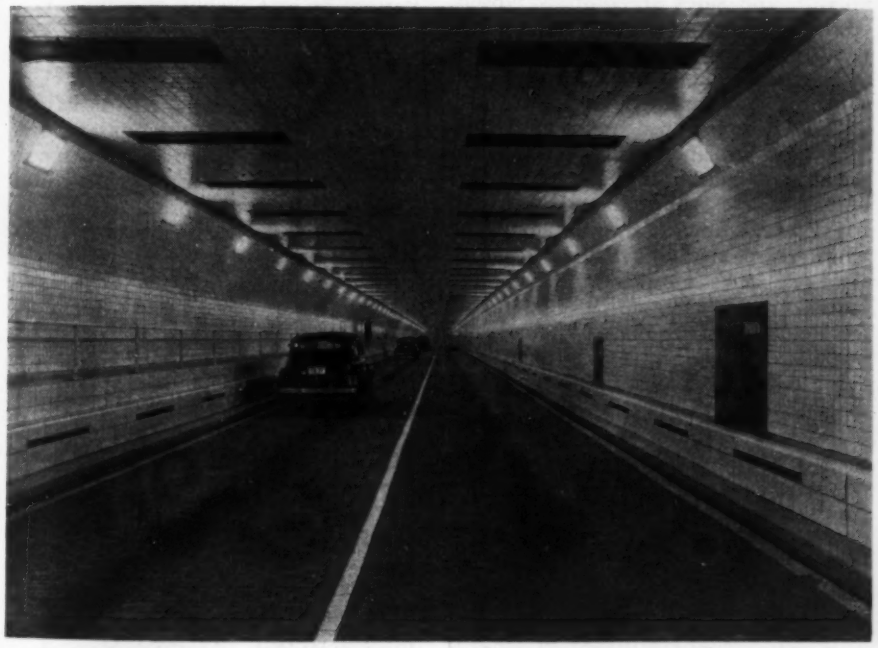


FIG. 2. REINFORCED CONCRETE LINING is not designed for full hydrostatic pressure, but is drained where necessary. Brick-paved roadway is 24 ft wide between curbs; minimum headroom is 14 ft 6 in. Sidewalk, about 3 ft wide and 3 ft 6 in. above tunnel roadway, is provided on north side for tunnel personnel and emergency use. Exhaust ports in tunnel ceiling lead directly to exhaust duct; flues from fresh-air ducts are carried down through sidewalks to outlets on both sides of tunnel short distance above roadway curb.



PROPOSED INTERIOR OF TUNNEL is similar to Queens Midtown Tunnel, pictured here, except for type of lighting, which will consist of new slimline fluorescent lamps in two continuous rows on each side of tunnel. Roadway is 3 ft wider and ceiling height 1 ft greater.

The largest of these items, amounting to over $65,000 for snow removal from the upper crossing of the Snoqualmie River to Hyak, would be practically eliminated if the road over the summit were closed during the winter months. This would affect only two types of travel: (1) The skiers who could conveniently, and with greater safety, reach the summit by using the tunnel and a short distance of highway from the tunnel to the summit, which could be kept open for this purpose at a small cost; (2) the oil and gasoline trucks, amounting to 25 per day. Oil and gasoline in bulk cannot be permitted to pass through the tunnel because of the fire hazard. There are other available means of transporting these products across the mountains than by truck in the event that the Snoqualmie Summit route is closed to traffic. The railroads serve all parts of the state and preliminary investigations indicate that oil and gasoline could be transported by pipeline from tidewater at Puget Sound to a central distributing point, such as Cle Elum, at about one-third of the present cost.

Electrical Transmission Lines

The power companies and the Bonneville Power Administration have advised that they are not interested in renting ducts in the tunnel for the transmission of power. The engineering and cost considerations for power lines of such high voltage favor overhead construction.

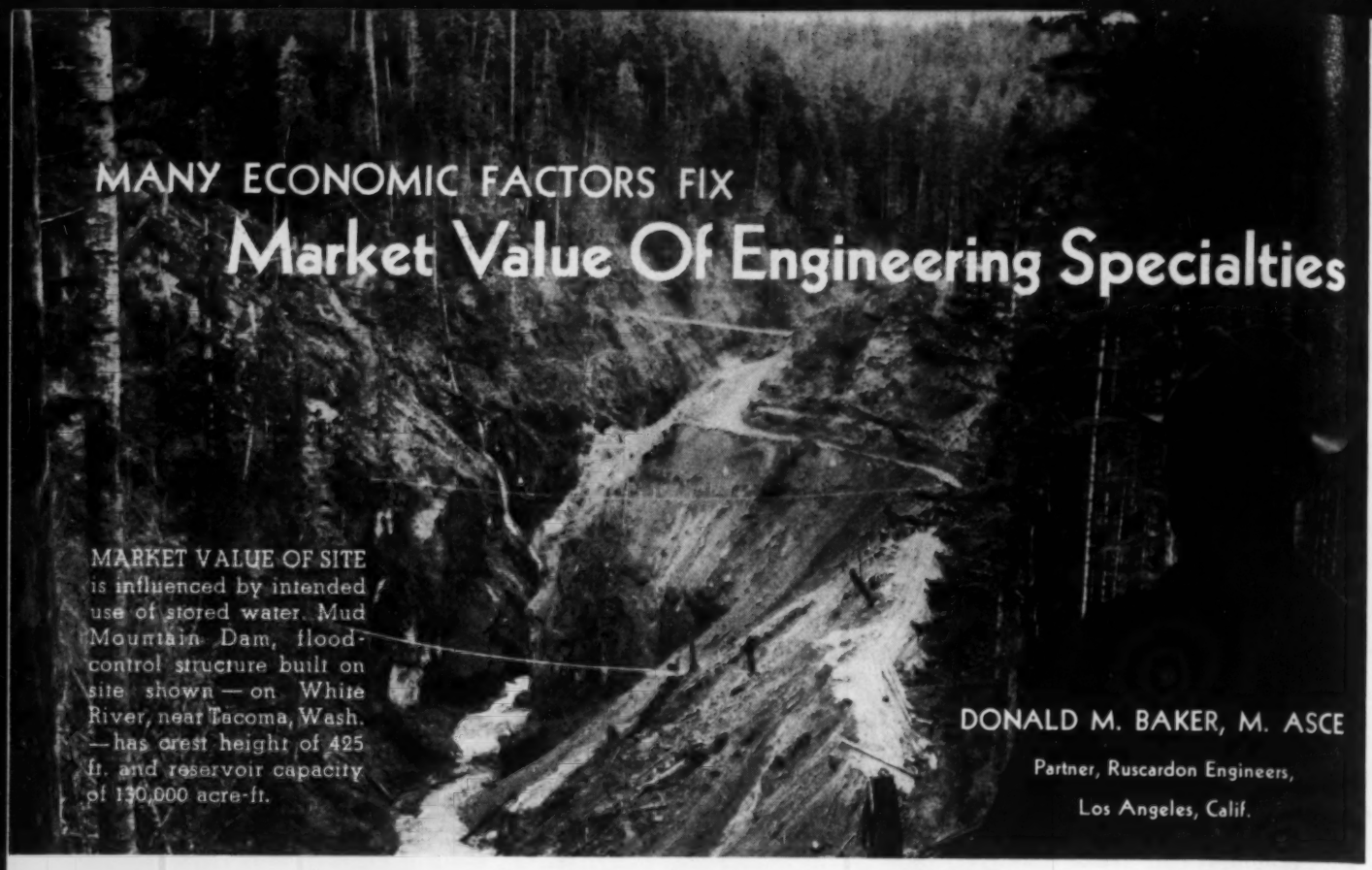
The Western Union Telegraph Co. can foresee no use by that company of duct space in the tunnel. The Pacific Telephone & Telegraph Co., on the other hand, has tentative plans for a crossing of the Cascade Mountains in this vicinity, and arrangements can be made for duct space in the tunnel to be rented by that company.

Present and Future Needs of the State

With only two places existing where it will be economically feasible, at any time that can now be foreseen, to cross the Cascade Mountains with an all-winter, all-traffic highway by means of a tunnel, and assuming that the decision is reached that the first crossing be made at Snoqualmie Pass, the present and prospective traffic for the next several years could, without difficulty, be handled through one two-lane tunnel, one lane in each direction. Such a tunnel, with the proposed grades, being well lighted and policed and protected against the weather, can handle, without inconvenience to the public, about four to five million vehicles per year.

(*Continued on page 70*)

MANY ECONOMIC FACTORS FIX
Market Value Of Engineering Specialties



MARKET VALUE OF SITE is influenced by intended use of stored water. Mud Mountain Dam, flood-control structure built on site shown — on White River, near Tacoma, Wash. — has crest height of 425 ft. and reservoir capacity of 130,000 acre-ft.

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Los Angeles, Calif.

MARKET VALUE has been defined in innumerable court decisions. It is essentially the highest price, expressed in monetary terms, which an owner would receive for a commodity if the latter were exposed for sale in the open market, a reasonable time being allowed in which to find a purchaser. Furthermore, both owner and purchaser are assumed to have full knowledge of the uses and adaptabilities of the commodity under consideration.

COMMODITIES EXCHANGED in the open market may be grouped in the following general classes, based on comparability of characteristics and uses of commodities of the same kind, volume and frequency of exchange transactions, effect of supply and demand on such exchange prices, availability of purchasers, and relative ease with which information as to adaptability and uses can be secured:

1. Commodities whose characteristics and uses make them interchangeable with others of the same kind, and in which exchange transactions constantly occur in substantial volume. In this class are such things as agricultural products—wheat, corn, cotton, many securities listed on exchanges, and commodities usually offered for public sale by established concerns. A bushel of wheat of a given grade is interchangeable with other bushels of the same grade, as is one share of U.S. Steel common stock with another. Hundreds of thousands of exchange transactions in these things occur daily. Prices respond quickly to supply and demand, purchasers are numerous, or can be developed by a slight reduction in offering prices; knowledge of the commodity is widespread, and sales are quickly closed. Market value can be established exactly, or within a very close range, at any particular time from records of sales transactions.

2. Those whose characteristics and uses are not sufficiently comparable to make them interchangeable, but are still sufficiently similar to allow comparison to be made of worth or utility with other commodities of the same kind. Exchange transactions occur with reasonable frequency. In this class will be found improved or unimproved real property, used machinery, equipment and motor vehicles, etc. No two parcels of farm or residential property, and no two used motor vehicles are ever identical as to worth or utility, but comparisons can be made without much difficulty. Sales of such commodities occur daily, weekly, or at least monthly. Sales prices in general respond to supply and demand, although not so readily as with commodities in the first class. Buyers can usually be found or developed by a reduction in asking prices.

3. Those whose uses and characteristics are only remotely comparable with those of others of the same kind, and in which sales transactions occur very infrequently. Included in this class would be rare gems, works of art, undeveloped oil or mineral deposits, reservoir, dam and water power sites, etc. This type of commodity may be termed a specialty. Items in this class are not even remotely interchangeable. Their value cannot be established or compared on any unit basis, such as weight, volume or area. Actual or potential purchasers are few in number; purchases are usually made to satisfy the need or desire of a particular buyer, and occur with relative infrequency. Supply and demand usually affect sales prices only remotely. Purchasers, if non-existent at a given time, can usually only be developed by very substantial reductions in asking prices.

Functions of an Engineering Appraiser

Determination of market value of certain specialties, particularly real or personal property utilized or to be utilized in connection with engineering projects or facilities, calls for the services of an engineering appraiser. The latter finds himself in the position of an impartial adviser, familiar with all the uses and adaptabilities of the commodity under appraisal, aware of the highest price which any potential buyer would be justified in paying for it in the immediate or distant future, and of the

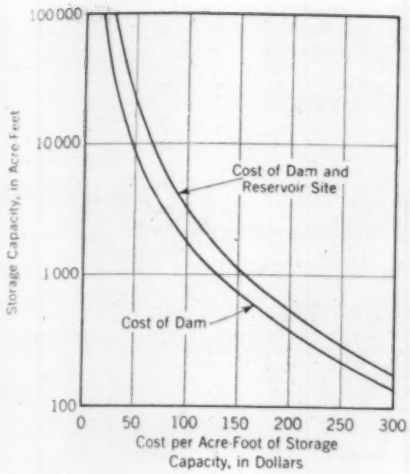


FIG. 1. **COST OF STORAGE RESERVOIRS** in San Diego County, California, is based on existing reservoirs with costs reduced to 1938–1939 basis.

lowest price which an owner will accept. He knows that an owner will have in mind a price below which he will not sell, and that one buyer will have a price higher than that offered by others, since the use to which he proposes to put the property will justify such price.

The market value which he assigns to property is that sum which he can consistently recommend to both owner and buyer as being fair to each of them, all things considered. To arrive at this value, rather extensive investigations of an engineering and economic character are usually necessary.

Market Value of a Reservoir Site

The following discussion briefly outlines the general approach to the determination of market value of a parcel of real property adaptable for use as a reservoir site, and illustrates the general procedure followed in formulating an opinion as to market value of this type of specialty. The following steps should be taken in collecting, analyzing and interpreting basic data:

1. The various uses to which the property is adaptable, and the approximate value for each of these uses, must be determined. In the case of ordinary uses, other than specialized ones, such as grazing, agriculture, subdivisions, etc., market value can usually be determined approximately from sales prices of comparable property in the general locality, and similar factors. The characteristics that make the property adaptable to storage purposes will usually make this purpose its highest and best use.

2. Assuming this to be the case, preliminary estimates must be made of the cost of developing storage on the property, including: (*a*) Cost of dam and appurtenant structures; (*b*) cost of clearing the reservoir basin; (*c*) cost of fencing (if necessary); (*d*) cost of removing and/or relocating roads, utilities, etc. Likewise it is necessary to determine the area required for flooding, for the dam site, and for land surrounding the flooded area (which is necessary for sanitation and other purposes). These studies should be carried out over a range of feasible storage capacity, and their results preferably reduced to graphical form.

3. The various water sources in the general area in connection with which the property might be utilized for storage purposes should be investigated, and studies made of the costs and feasibility of their use in connection with the property under appraisal. Such study should likewise consider the probability of their being developed, the amount of storage capacity required at the site under appraisal in connection with their development, and the probable time when such development can be expected to take place.

Lack of current need for the development of storage on the property under appraisal is no indication that such need will not arise within a reasonable time in the future. Purchasers for this type of property are not numerous in any locality, and seldom can an owner create them.

Communities develop slowly, although it is their development and growth that creates the need for storage. Years usually elapse between the time when an engineering project is first conceived and the time when its construction is commenced. Ten years is not an unreasonable time in which to assume that a buyer for a reservoir site can be found, and in some instances 25 years or an even longer period would not be considered unreasonable. The longer the period assumed, however, the less the market value. It may even happen that the length of the period will be so long that when it is terminated the property will be found to have a higher value for some other use. Frequently, a situation will arise in which the appraiser reaches the opinion that a property would probably be purchased for a certain sum within, say, five years, but that a much larger development could be reasonably expected within 15 years in connection with which it would bring a much higher price. In such a case, many factors must be considered before arriving at a price, somewhere between these two extreme figures, that might be considered as a fair market value.

Matters to Be Taken Into Consideration

Market value of this type of property cannot be computed by means of mathematical formulas or statistical calculations. Many other factors, tangible and intangible, must be taken into consideration. Buyers are not buying real estate but are acquiring potential storage capacity, and are interested in the total cost of creating actual capacity, including the cost of land, improvements and utilization. The higher the cost of improvements and utilization, the less a buyer is able or willing to pay for the land constituting the reservoir site. A property where 100,000 acre-ft of storage capacity could be created at an improvement cost of $6,000,000, other things being equal, would have a higher value than one of similar capacity that entailed an improvement cost of $10,000,000. Furthermore, a long and expensive conduit to bring water to a site, or to transmit it from the site to its place of use, would tend to reduce market value.

A number of general factors must likewise be considered. Cost of money—interest rates—will affect market value. Higher capital investments are usually justified under low, than under high, interest rates. Use made of the water stored in the contemplated reservoir will often influence market value. Where water is to be used for municipal purposes, or for irrigation of high priced agricultural crops, a far higher price could and probably would be paid for a reservoir site than where the

GROWTH OF COMMUNITIES creates need for stored water. Regulation and terminal storage on Owens Valley Aqueduct of City of Los Angeles is purpose of Bouquet Canyon Dam, designed to impound 36,200 acre-ft. Rolled earth-fill structure, constructed at cost of $2,108,621, rises 225 ft above bedrock.

PRICE OF RESERVOIR PROPERTIES is influenced by fact that purchasers are not numerous and seldom can owners create them. Site pictured is that of Long Valley Dam, on Owens River in California. Rolled earth-fill structure, built at cost of $1,379,050, rises 102 ft above bedrock and impounds 163,000 acre-ft.

MARKET VALUE OF PROPERTY cannot be computed by formulas or statistical computations. Site pictured is that of Sunshine Dam on Greybull River, Wyoming, rolled earth-fill structure with crest height of 135 ft above streambed; purpose, conservation storage for Greybull Irrigation District.

water is to be used for the irrigation of meadow hay. Flood control storage to prevent damage to high priced urban property might justify a higher cost of storage capacity, and probably a higher price for a storage site, than would storage for irrigation purposes. Where multi-purpose storage is to be created, such as for irrigation and development of hydroelectric power, this fact may enhance the value of the site. Where water is to be stored for several years and evaporation rates in the area are high, a reservoir basin with large surface area in relation to depth of water may have a lower value than a deeper basin, even though the latter requires a somewhat more expensive dam.

Usually there will be a number of properties in any general locality adaptable for storage development. One or more of these may be competitive in character with the site under appraisal. It must be assumed that probable purchasers would investigate such competitive sites and take into consideration their cost of development and utilization, in comparison with those of the site under appraisal. Scarcity of sites that can be economically developed and utilized will tend to raise the market value of an economical site, while the existence of a large number of economical sites will tend to reduce such market value.

Final determination of market value will usually be arrived at by a process of successive approximations. After the studies and investigations of the character outlined above have been completed, a range of probable values will result. Somewhere within this range, the appraiser will finally decide on the figure which he feels he can best defend to both buyer and owner, contemplated in the definition of market value, as the fairest price that he can conscientiously recommend jointly to them. This he will select as his figure for a market value.

Valuation of Separate Parcels

Sometimes an appraiser must determine the market value, not of a complete reservoir site, but of a dam site, a reservoir basin, or of one or more parcels of land within one of these areas. It must be borne in mind that it is the potential capacity of the entire site that gives it its value for storage purposes. A dam site that has little or no storage capacity in its reservoir basin, or a basin that cannot be economically closed by a dam, will have no value for storage purposes, although it may have for other uses. Sometimes appraisers will assign one-half of the market value of an entire reservoir site to the dam site and one-half to the reservoir basin. This procedure may be equitable in some cases, but frequently it is not, as it does not recognize particular advantages or disadvantages inherent in the two component parts of the reservoir site. A more suitable approach, although somewhat approximate, would be as follows.

A reasonable measure of the relative economy of a dam site is the cost of a dam of the required height as compared with actual or estimated costs of dams of the same height at other sites in the general locality. Similarly, the measure of the relative economy of storage in a reservoir basin is the cost of the construction work necessary to create a given storage capacity in this basin as compared with the cost of creating the same amount of storage in other reservoir basins in the general locality. Data on these costs for both developed and undeveloped sites are usually available, or can be readily secured. Costs should be reduced, through use of an index of construction costs, to the date when the appraisal is made.

For Purposes of Illustration

By way of illustration, assume that the market value of a 100,000 acre-ft reservoir site is determined as $300,000, requiring a dam 200 ft high which, with appurtenant structures, costs $2,500,000, and that investigations indicate that the average cost of dams of this height in the general locality, based upon current prices, is $3,000,000. Furthermore, the average cost of development work, exclusive of site, but including dam, appurtenant structures, etc., for reservoirs of 100,000 acre-ft capacity in the general locality is found to be about $3,500,000, primarily because dams higher than 200 ft are required to create this amount of storage capacity. These data indicate an economy of $500,000 due to favorable conditions at the dam site, and one of $1,000,000 due to favorable conditions in the reservoir basin. It would be reasonable, therefore, after crediting both dam site and reservoir basin with a sum equal to their value based on their next highest use, to prorate the remainder of the assigned market value to the entire reservoir site on the basis of one-third to the

dam site and two-thirds to the reservoir basin.

Had a 200-ft dam at this site been found to cost $3,500,000, or $500,000 more than the average cost of dams of this height in the locality, the dam site would be found to be more expensive than the average to develop, with the cost of developing storage in the reservoir basin equaling average local costs. In such a case, other matters would probably have to be taken into consideration in apportioning the total market value.

Market value of separate parcels within the dam site or reservoir basin can usually be determined by prorating the total market value of the dam or reservoir site to each parcel under an area basis. Even if a portion of a reservoir basin lies in the public domain, and can be acquired at nominal cost, or if only a part of such a site is to be appraised, its market value as a whole must first be determined, as the value is created

(*Continued on page 70*)

New Concrete Test Houses Accommodate 30-Ft Propellers

FACILITIES FOR TESTING aircraft propellers, unique in private enterprise, were recently completed by Turner Construction Co., general contractors, New York, N.Y., for Hamilton Standard Propellers Division of United Aircraft Corp., East Hartford, Conn.

Because of the original research and experimental nature of prop testing, with no two installations hewing to any set pattern, the engineering work was mainly that of Hamilton and United Aircraft technicians. Albert Kahn Associated Architects and Engineers, Inc., provided the structure to house the testing facilities designed by these technicians.

Design Features

Among the unusual features highlighted by the structural engineering department of the Kahn organization are:

1. Two 30-ft test cells each capable of accommodating props up to 30 ft.
2. Folding steel closures at both ends of both cells, each curtain 33 ft square.
3. Sound-proofing designed to give a measured average sound reduction of not less than 40 decibels, averaged over a frequency range of 128 to 2,070 cycles at not less than 25 test frequencies.
4. Retracting sections of the work platform which help provide test conditions simulating a plane in flight.
5. Adjustable orifice which provides air streams ranging from 15 to 30 ft in diameter for ideal testing of various sized props.

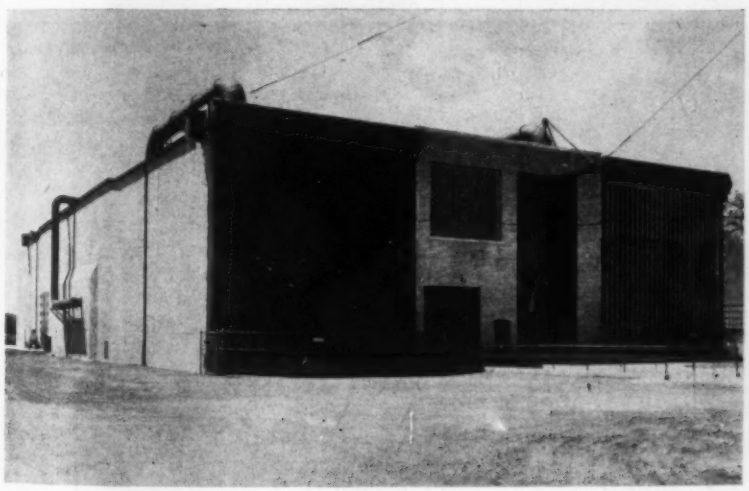
Easy Access to Cells

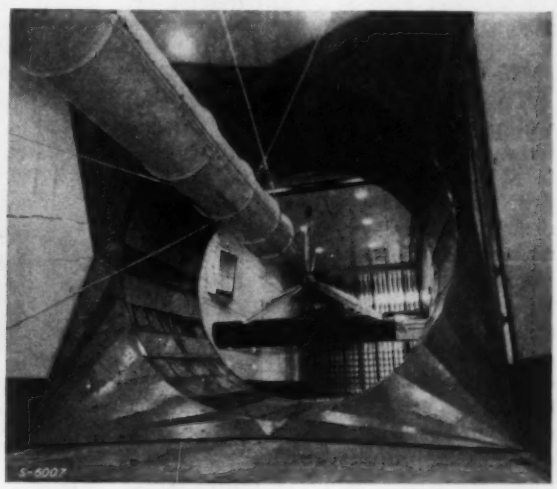
All operations are housed in a rectangular shaped concrete building 212 ft 10 in. long, 112 ft wide and 63 ft high, with a flat roof of steel and concrete tile over the service section. Sound-proofed doors 33 ft high and 5 ft wide provide access to the test cells and permit a completely assembled prop to be set up outside and conveyed to the test position. Separate cranes within each cell lift the engine and prop to a mounting platform similar to a plane wing.

Cooling System

Engines used on tests are cooled by a jet blower consisting of 600-hp centrifugal-type fan delivering 70,000 cfm at $1^1/_2$ lb per sq in. static pressure. Cooled air is carried from the fan room on the roof through a 175-ft duct, 35 in. in diameter at its extremity, which can be telescoped in front of the engine to provide room for assembling and servicing of engine and props. Provision is made for future jet cooling installations on the roof if needed.

A two-cell unit, induced-draft cooling tower above the roof level of the test cells processes 1,000 gal of water per minute and cools the water from its 130-deg temperature, absorbed during the air and oil cooling operations, to a maximum of 83 deg. Air entering the building is filtered to keep dust and dirt to a minimum for protection of delicate equipment.





CONCRETE TEST HOUSES (left) are designed to handle two simultaneous tests of 30-ft propellers. Baffles at exhaust end of test cell (at right in photo) limit noise of propellers and engines in test. Rolling steel curtain approximately 33 ft square, covers door of cell at left. Adjustable orifice (right) consists of overlapping steel plates each 15 x 3 ft, hinged at one end and rolled to desired curvature. Here 20-ft-dia propeller is ready for test with orifice expanded to its full 30-ft dia. Air duct, supported by cables, brings cooling air to engine.

Model Study Develops Stepped Transition for Mt. Morris Dam Stilling Basin

GEORGE F. SOWERS, JUN. ASCE

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HYDRAULIC MODEL STUDIES on the proposed Mount Morris Dam have resulted in a stilling basin design that can be constructed for nearly $700,000 less than that of any equally effective alternate. Based on tests made in the Warner Hydraulics Laboratory of Case School of Applied Science, a stepped transition between the downstream face of the dam and the training walls was developed which corrected a serious velocity distribution problem and made the use of sloping training walls possible.

AN UNUSUAL PROBLEM was encountered in the preliminary design of the stilling basin for the Mount Morris Dam, in that there was too much tailwater at all discharges for a satisfactory hydraulic jump. The proposed dam and reservoir, which comprise one of a series of flood control projects planned by the U.S. Engineer Office, Buffalo, N.Y., will be located on the Genesee River about 28 miles southwest of Rochester. The dam is to be of the concrete gravity type with a spillway crest length of 550 ft, 203 ft above the downstream apron.

The largest flood at the dam site on record is about 40,000 cfs. The spillway section is designed for a superflood of 320,000 cfs with a head of 28 ft on the crest. The spillway will be uncontrolled; release of water below the crest level will be through sluices that have a total capacity of 27,000 cfs.

Too Much Tailwater Complicates Design

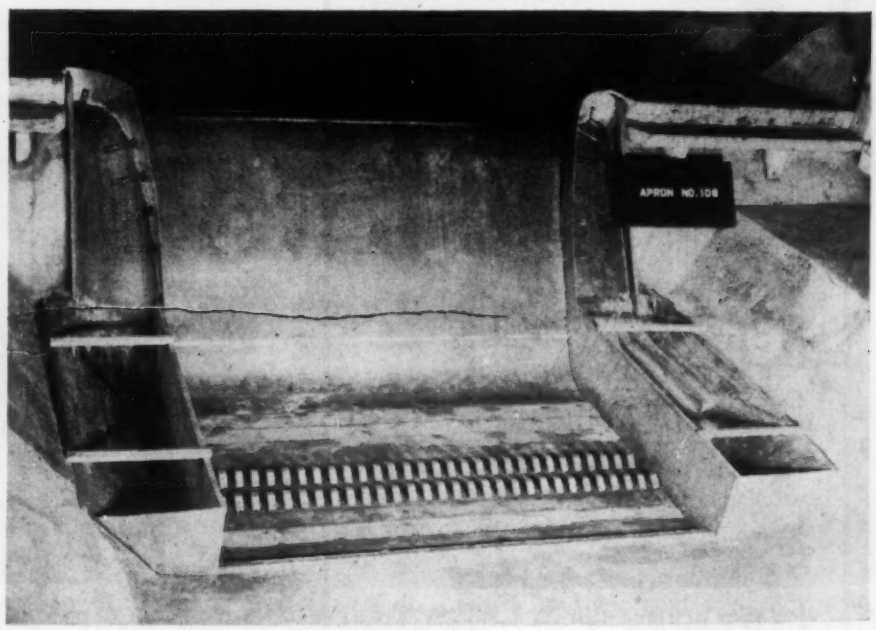
To dissipate the energy of the water flowing over the crest of the dam, a stilling basin extending 180 ft downstream from the bucket was proposed. This stilling basin was designed to be as wide as the spillway—550 ft—and had vertical training walls on each side. The fact that there is too much tailwater at all discharges to form a satisfactory hydraulic jump complicated the design of the basin. Tests were made on a 1 : 64-scale, sectional model of the dam and stilling basin in the hydraulics laboratory at Case to determine an arrangement of baffle piers and a shape of end sill to prevent scour in the river bed below the apron. The design developed in the early studies included a stepped end sill, 12 ft high, and two rows of baffle piers 8 ft high within the basin to help stabilize the stilling action.

Investigations of the rock at the dam site made after these tests were completed disclosed weaknesses that made it impractical to construct vertical training walls with a basin of 550-ft width. The original design was therefore altered to provide for training walls sloping 1 : 1 and extending 43 ft into the stilling basin. At the junction of each sloped training wall and the downstream face of the dam a fillet with a 50-ft radius was placed to guide the water overflowing at the edge of the spillway into the stilling basin.

Preliminary tests on the sectional model disclosed that the original basin, which was designed for vertical training walls, was inadequate when modified to make the walls slope into the basin. The overflowing water, striking the fillet, was directed laterally into the stilling basin on each side at an angle of about 30 deg with the normal direction of flow, and formed a high-velocity jet extending far downstream from the end sill. This jetting caused the whole stilling action to become unstable and caused non-uniform and scouring velocities in the river bed below the sill.

Complete Model Constructed

It was believed that a sectional model could not be used to find a solution to this problem of flow distribution; therefore a general model of the dam and the river valley above and below the dam was constructed on a scale of 1 : 100 in the laboratory. Three distinct modifications of the basin were tested: (1) Baffles and deflectors within the basin to break up the jetting action; (2) a much narrowed basin, permitting the use of vertical training walls coupled with a chute spillway; (3) various transitions between the training walls and the face of the dam to prevent the formation of the jets.



MODEL PROVES INADEQUACY of narrow stilling basin. Elliptical spray walls and gravity-type training walls decrease effective crest width and increase cost $700,000.

Several methods were used to break the force of the jets. Larger baffle piers, with extra rows placed in the path of the jets, were employed. Although they reduced the velocity of the water to less than the prescribed limits, the stilling action was far from satisfactory. The energy of the water was dissipated by impact on the piers alone, and the loss of these piers by erosion, as has occurred in some dams, would be disastrous. Another possible modification of the basin was to place a wall, 20 ft high, parallel with and close to the training wall and extending downstream from the face of the dam, to deflect the jet into a downstream path. While this tended to correct the uneven velocity distribution at the end sill, the action within the stilling basin was so turbulent and unsteady, and the forces acting on the wall so great, that the design was considered unsatisfactory.

STEPPED TRANSITION between sloped training wall and face of dam directs water downstream, while baffles in stilling basin help maintain stable flow. Curved bucket at intersection of each step and face of dam guides water onto step. Steps are 10 to 12 ft in width and depth.

Narrower Stilling Basin Rejected

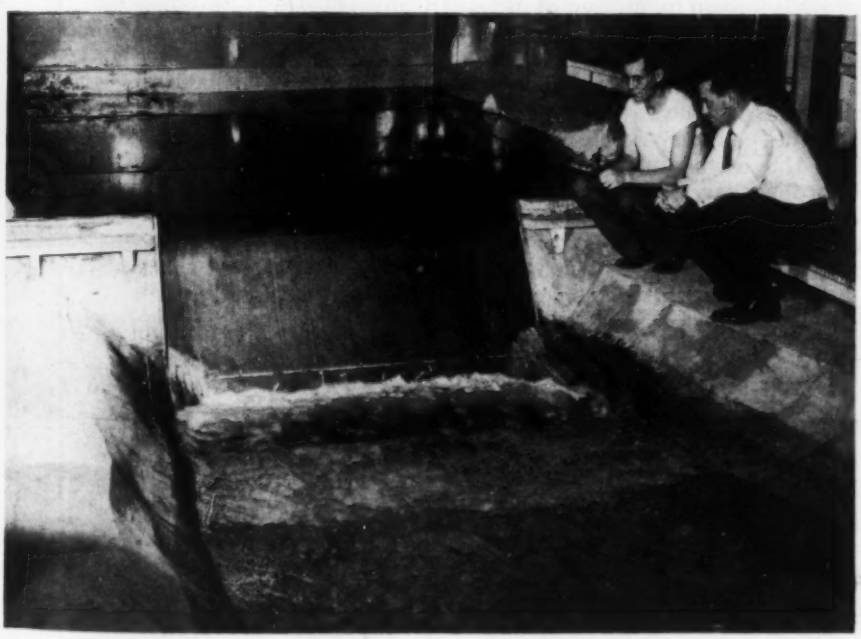
The second method of correcting the flow distribution was to decrease the width of the stilling basin, as shown in an accompanying photograph, so that vertical training walls could be employed. In order to have room for gravity walls at the toe of the rock slope of the valley, the basin width would have to be reduced to 404 ft. This is narrow enough, incidentally, to cause a good hydraulic jump to form at higher flows.

To bring the water coming over the 550-ft spillway into the narrow basin below, it was necessary to use a curved spray wall. This wall, elliptical in plan, directed the water into the stilling basin uniformly, and in a downstream path. The stilling action with the narrow basin was excellent, for the energy was dissipated largely in the turbulence of the hydraulic jump. The design had two drawbacks, however. The elliptical walls narrowed the effective crest width to 500 ft, making it necessary to raise the reservoir elevation about 3 ft to secure maximum discharge; and the estimated additional cost of the curved spray walls and gravity-type training walls was nearly $700,000.

Stepped Transition Solves Problem

The third alternative was to redesign the transition between the sloped training wall and the face of the dam to direct the water downstream instead of into the center of the stilling basin. A novel design was developed by the writer, consisting of four steps, from 10 to 12 ft in width and height, placed on each training wall, extending horizontally downstream from the face of the dam. A photograph shows the relationship between these steps and the spillway.

At the intersection of each step and the face of the dam was placed a curved bucket to guide the water onto the step. The water coming down each side of the spillway struck the buckets and flowed out on the steps, moving in a downstream direction. As it lost its velocity, most of the water fell over the side of the steps into the basin, but did not materially affect the stilling action. Baffle piers were used in the stilling basin to help maintain a stable action, but they were small and located for enough downstream to avoid impact with the high-velocity water coming down the spillway. As can be seen in another photograph, the stilling basin functioned smoothly, and velocities at the end sill and in the river below the apron were uniform and well below the prescribed limits.



SMOOTH FLOW IN STILLING BASIN of hydraulic model proves satisfactory behavior of stepped training walls.

Large Saving Realized

Construction of the steps and the buckets would involve no special difficulties, and the quantities of concrete needed would be nominal. Since the estimated cost of the stepped transition was nearly $700,000 less than that of the narrow stilling basin with elliptical spray walls, the stepped design was adopted.

The Mount Morris project is under the direction of Col. H. D. Vogel, M. ASCE, District Engineer. Professor George E. Barnes, M. ASCE, of Case School of Applied Science, was consulting engineer and supervising engineer on tests. The laboratory staff at Case included Harry H. Ambrose, Jun. ASCE, associate hydraulic engineer, and John W. Parma and the writer, assistant engineers.

NATURE PROVIDES LAB FOR
Maintenance Studies on Hydroelectric Plant Structures

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SINCE THE RANGE IN CLIMATE and age of the hydroelectric plants discussed herein is characteristic of a large number of concrete structures in the United States and Canada, experience in maintaining and repairing these structures should be of considerable value to engineers who face similar problems. The Southern California Edison Co., Ltd., owns or operates 23 hydroelectric plants with their associated dam and water conduits. These plants have a capacity of 872,000 kw and range in age from 14 to 53 years. The company also operates a 412,000-kw steam station, portions of which range in age from 5 to 35 years. The steam station is on tidewater while the hydro plants are between El. 900 ft and 4,800 ft with dams and associated structures up to El. 10,800 ft. As a result of their different locations and elevations, the climate to which these concrete structures are subjected varies from subtropical with no concrete temperature below freezing, to arctic with frequent below-zero temperatures and snow cover for 9 months of the year.

ON THE SOUTHERN CALIFORNIA EDISON CO. SYSTEM, the principal examples of concrete structures requiring repair and surface restoration as a result of weathering are located in the Sierra Nevada at elevations between 5,000 and 7,300 ft. In this region, because of frequent cloudless days in mid-winter, the surface temperatures of concrete structures are relatively high in the middle of the day but fall to very low values at night. For example, the temperature of a black painted concrete surface in full sun on a typical day may reach 80 to 90 deg F around noon, and drop to from zero to 10 deg F at night. A white or aluminum painted surface shows about half this change.

Concrete surface temperatures, in general, have a much wider daily variation than the air temperature in the shade. Such variations in temperature may result in as many as 200 cycles of freezing and thawing per year for exposed portions of structures, particularly if they are dark in color. When the freezing and thawing action is combined with occasional wetting and drying, an exceptionally severe weathering condition results. In laboratory tests, concrete which stands 200 cycles of freezing and thawing without spalling or disruption is generally considered to be very good. Certain parts of the Company's structures have endured the equivalent of a severe laboratory test every year for 20 years, so it is not surprising that after some years the effects of weathering have become apparent even though the concrete may have been originally of very good quality.

Maintenance of Multiple-Arch Dam

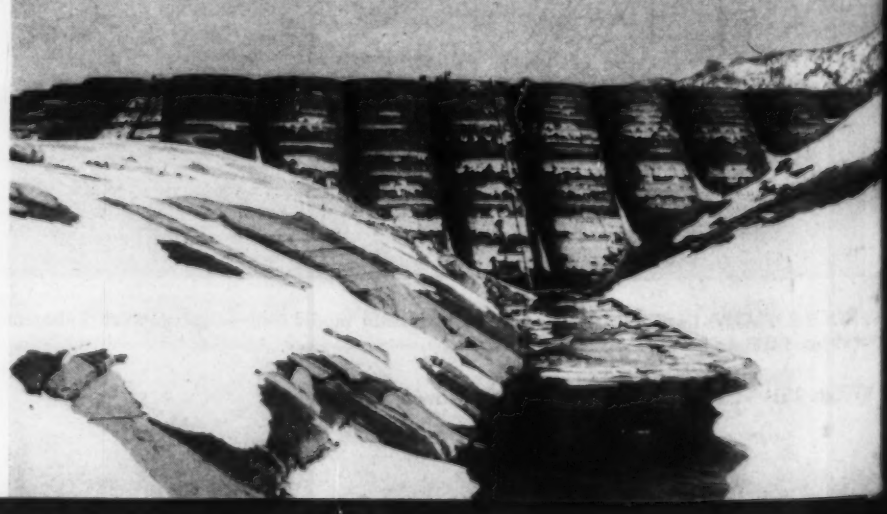
A typical example of maintenance made necessary by severe weathering conditions is that required on parts of the Florence Lake Dam, a large multiple-arch structure built in 1925–1926 at El. 7,300 ft. After 15 years of service, the dam required repairs to the upstream face, to the spillway section, and to the walkway along the crest. The upstream face, which is formed by fifty-eight inclined arches, each of 50-ft span, showed spalling on the areas exposed to severe temperature changes and to wetting from rain and snow.

Since the reservoir is emptied each fall, the arches suffered no winter drawdown exposure. Portions of the arches that were covered with as little as one foot of backfill or debris, showed no deterioration whatsoever, and deterioration was generally slight in shaded areas not exposed to large daily temperature changes. Concrete in arches and supporting buttresses that was not exposed to rain and snow or reservoir water has shown no damage from weathering in more than 20 years. Consideration of these facts led to the conclusion that if the concrete could be kept dry or protected from an excessive number of cycles of freezing and thawing while saturated with water, the deterioration would be stopped.

Asphalt-Asbestos Membrane

Repairs to the arches were made in the years 1940 to 1943 by chipping away all spalled or deteriorated concrete, smoothing rough or deeply pitted areas with Gunite or mortar, and covering the whole face of the dam with a built-up membrane consisting of a troweled-on layer of Johns-Manville Asbestile, a layer of 15-lb asphalt-saturated asbestos felt, and a second layer of Asbestile. Special reinforcing at horizontal day's-work joints in the structure

UPSTREAM FACE OF FLORENCE LAKE DAM, constructed in 1925–1926, shows spalling on areas exposed to severe temperature changes and wetting by rain and snow over 20-year period. White streaks are results of previous repairs on horizontal joints.



LAYER OF ASBESTILE APPLIED to face of arch is followed by layer of asphalt-saturated asbestos felt and second layer of Asbestile.

was given by applying an additional 1-ft-wide strip of 30-lb asbestos felt and an additional layer of Asbestile. The felt was held in place by short concrete nails along the upper side of each strip.

Experience with this built-up membrane has been generally satisfactory, although some annual maintenance is necessary each spring before the reservoir is filled. During the first year of its life the coating is occasionally damaged by snow drifts up to a depth of 30 ft, which drag across the surface as the snow settles. Damage from this cause in later years is minor because of the gradual hardening of the membrane. There is occasional damage from floating logs but the greatest amount of repair is required because of punctures in the membrane resulting from water pressure at points where the coating bridged over local depressions in the concrete.

In spite of the defects just mentioned, the coating has been effective in cutting off at least 95 percent of the percolation of water into and through the concrete, and in preserving the concrete from further deterioration. To make sure that deterioration is not progressing underneath the coating, concrete core samples have been taken every two years from eight of the arches at points where the concrete showed the maximum deterioration before application of the protective membrane.

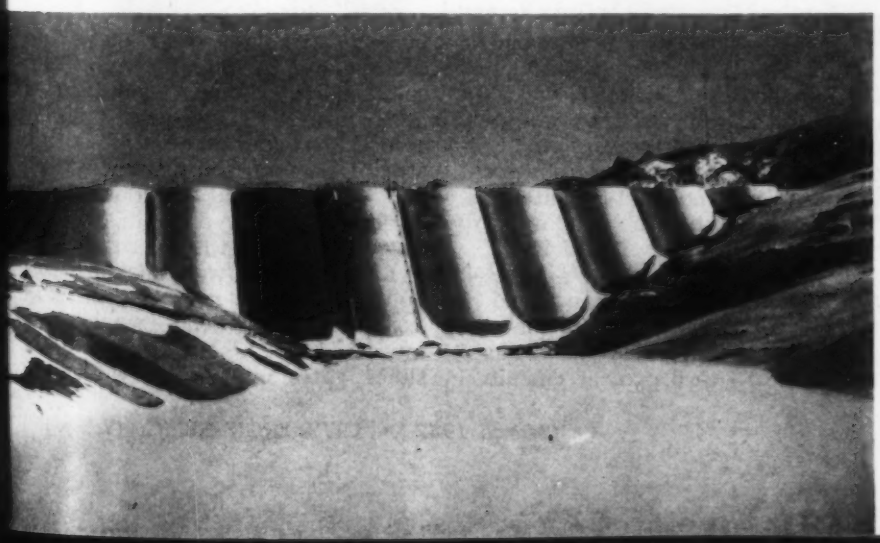
Steel Facing and Gunite Covering Tried

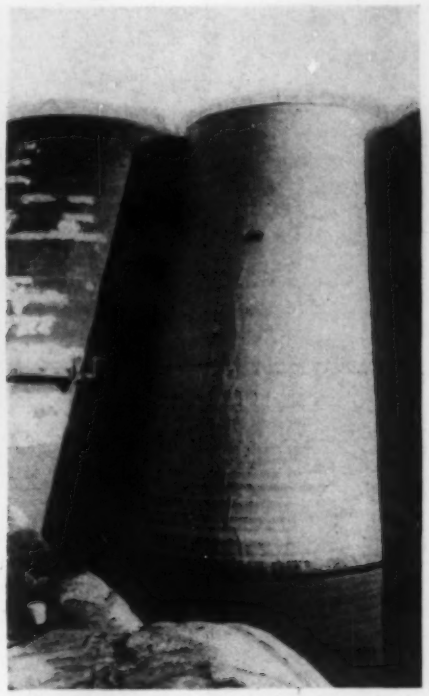
Other methods of protecting the arch concrete have also been tried. The most successful have been a steel facing and also a reinforced and anchored Gunite covering.

A facing of welded 12-gage black steel sheets was applied to one arch in 1942. The steel face was sealed at the bottom and sides by imbedment in gunite-filled grooves. The sheet was fastened with anchor bolts on approximately 4×7-ft spacing. The anchor bolts were welded where they passed through the steel sheets. No provision was made for expansion or contraction of the steel other than the slight buckling that takes place between the anchor bolts.

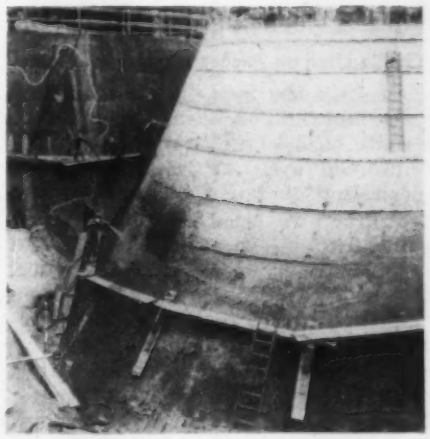
In spite of dire predictions, there has been no difficulty from tearing of the steel sheets or cracking around the anchor bolts. Coupon tests taken from the sheet every two years have shown that rusting on the unpainted bottom surface is unimportant. The water face of the sheet is protected by paint. Although the first cost of the

REPAIR OF ARCHES cuts off at least 95 percent of percolation. Material used is Johns-Manville Asbestile. Repair consists of chipping away all spalled or deteriorated concrete, smoothing rough or deeply pitted areas with Gunite or mortar, and covering with layer of Asbestile.

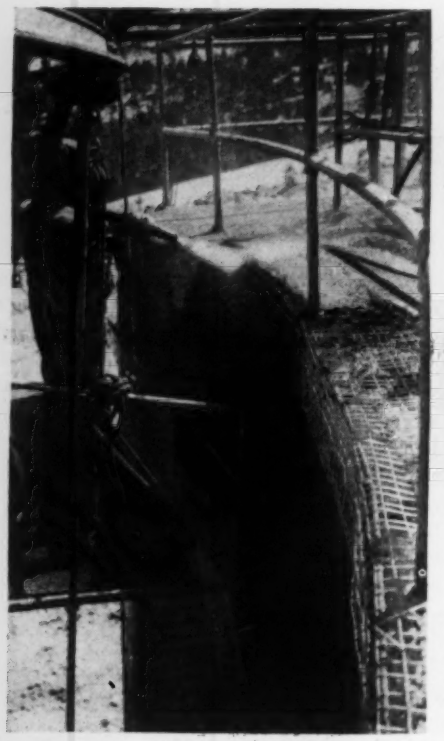


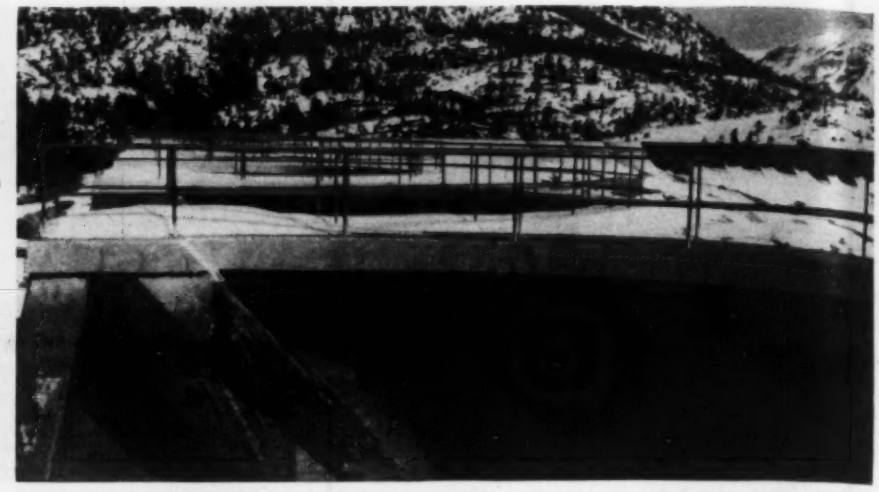


STEEL SHEETS COVERING ARCH are fastened with anchor bolts. For complete seal, bolts are welded where they pass through sheets. Although no provision is made for expansion, except slight buckling between anchor bolts, sheets do not tear or crack around bolts.



ARCH IN LOW SECTION OF DAM is successfully repaired with 2-in.-thick Gunite, reinforced with 3×3-in. No. 6 wire mesh anchored by dowels 36 in. on centers.





SPALLING OF WALKWAY at Florence Lake Dam, caused by 15 years' service, is repaired by Guniting to maximum thickness of 1 ft over new anchoring steel welded to old reinforcement. Five years after Gunite repair (right), walkway is still in good condition.

steel sheet facing was considerably greater than the cost of the Asbestile membrane, the steel facing would have been used on a large part of the dam on account of its positive watertightness and low maintenance cost if the war emergency had not made steel critically scarce.

Gunite Used on Arches and Dam Walkway

In 1940 the face of one relatively short and rigid arch was covered with Gunite. The Gunite was 2 in. thick, reinforced with 3×3-in. No. 6 wire mesh, and anchored by short dowels set on 36-in. centers. The coating proved to be watertight, and as a result of this successful experience, two other arches having a length on the slope of 175 to 200 ft were similarly Gunited during successive seasons. Neither of these were watertight, probably because the greater length of the high arches caused cracks to open through the Gunite during the cold weather. These cracks permitted water to enter and caused loosening of the bond.

Gunite has been used successfully on the repair of the Florence Lake Dam walkway. After 15 years of service, the walkway corners were spalled to a depth of several inches and the surface of the walkway itself had generally lost about 1 in. of concrete. Repair was made by chipping away the surface to sound material, or locally to a greater depth to expose sufficient reinforcing steel to permit welding on of the new anchoring steel. A 3×3-in. No. 6 wire mesh was fixed to the anchors over the whole area of the walkway and down 1 ft below the top, and covered with a minimum of 2 in. of Gunite. On badly corroded corners, and where notches were cut to the reinforcing steel, the Gunite reached a maximum thickness of 1 ft.

Experience showed that while the Gunite was very resistant to freezing and thawing, it developed porosity and shrinkage cracks which allowed water to work through the coating and attack the concrete beneath. Penetration of water was prevented by treating the surface of the Gunite with three coats of raw linseed oil applied at 150 deg F after the Gunite had been allowed to weather at least six months. Following the linseed oil, a coat of light reflecting paint was applied. The linseed oil effectively sealed pores in the Gunite and also the shrinkage cracks formed by drying and temperature changes.

The light reflecting paint reduced the daily temperature change from 20 to 40 deg F and thus reduced the stresses from expansion and contraction in the Gunite. The walkway repair is in excellent condition after six years of service.

Air-Entrained Concrete for Spillway Repairs

The ogee downstream face of the spillway section, which developed local spalled areas after 17 years of exposure, was repaired by chipping the deteriorated surface to sound concrete, installing drains in grooves cut in the old concrete at 10-ft intervals, and encasing the entire face in a slab of concrete 9 to 12 in. thick. The slab was reinforced with $^3/_4$-in. steel, 3 ft on centers, and was anchored to the old concrete with $^3/_4$-in. dowels, 3 ft on centers. Vinsol resin was used to produce 3 to 6 percent entrained air in the concrete. To date there has been no damage from freezing and thawing, even though the best quality concrete, made with the same cement and aggregate but without air entrainment, has shown spalling in from two to three years.

Gravity-Dam Maintenance

Three large gravity concrete dams at El. 7,000, built in 1912 and 1913 and raised during 1917, have required extensive maintenance as a result of weathering. Briefly summarized, the concrete disintegration observed up to the time the various protective measures were taken may be described as follows:

1. A non-uniform spalling of the upstream face through the middle portion of the dams, which is normally affected by changing water levels in the winter season. Negligible spalling on upstream surfaces not normally wet during the winter.
2. No disintegration of surfaces that are kept dry at all times.
3. No disintegration of surfaces that are normally under water the year round.
4. No disintegration of buried or backfilled concrete.
5. Spalling of horizontal and sloping surfaces on which snow can accumulate, particularly where such surfaces are exposed to sunshine.

Because of the low cost of readily available backfill material, the downstream face of one dam was backfilled in 1935 and the downstream faces of the other dams in 1936 and 1937. In 1945 the upstream faces of all three dams were backfilled to a point above the normal water level except where backfill would have interfered with the operation of sluice gates and outlet works. In

1939, approximately 32,000 sq ft of reinforced and anchored Gunite from 2 to 18 in. thick was placed on portions of the upstream face that could not be backfilled or that showed shrinkage cracks and leakage.

Since permeability-test cells show that reservoir water passes slowly through the Gunite even though cracks are extremely rare, the coating is considered to be a temporary protection until a more permanent covering, such as a concrete facing slab or steel plate facing, can be placed. However, the Gunite slab has been entirely successful in shutting off leaks through cracks and construction joints and in stopping concrete spalling.

Dam Joints Grouted

Repairs are proposed in the near future on a number of horizontal day's work joints in a large gravity dam at El. 5,300. Not all the joints show leakage but where leakage once occurs in any appreciable quantity, the passageway becomes enlarged as a result of solution of the cement by the soft and slightly acid reservoir water. Shutting off of such leakage is desirable.

An experimental grouting of the horizontal joints in two sections of the dam in 1945 has shown that with special methods, developed by the Portland Cement Association, cracks as small as two or three thousandths of an inch can be grouted. The special methods consist of the use of a very small high-pressure pump, a novel type of injection nozzle, and an ultra-fine portland cement, air-separated to minus 40 micron size.

To improve the appearance of the structure and prevent further enlargement of the joints, it is proposed to grout all joints showing leakage within the next year

At the Company's steam station located on tidewater at Long Beach, there have been a few minor examples of concrete damage as a result of the corrosion of reinforcement steel, particularly in portions of the structure just above the low-tide level. Such damage has always occurred where the imbedment of the steel was less than 1 in. and where the quality of the concrete was not of the best. In such cases the salt water traveled along the bottom of the reinforcement steel, resulting in a large volume of corrosion products which split the concrete. Experience has shown that there is never any attack where the steel is imbedded a minimum of 3 in. in concrete of good quality.

In the same steam station there is an example of damage to concrete from chemical attack on the reinforcement steel as a result of the accidental spilling of concentrated solutions of phosphates used for treating boiler water. The solutions penetrated joints and cracks in a concrete floor, rusting the steel and causing the concrete to split along the lines of the steel. In neither of these cases has the damage to the concrete been great enough to require extensive repairs but the examples illustrate what might happen under unfavorable conditions.

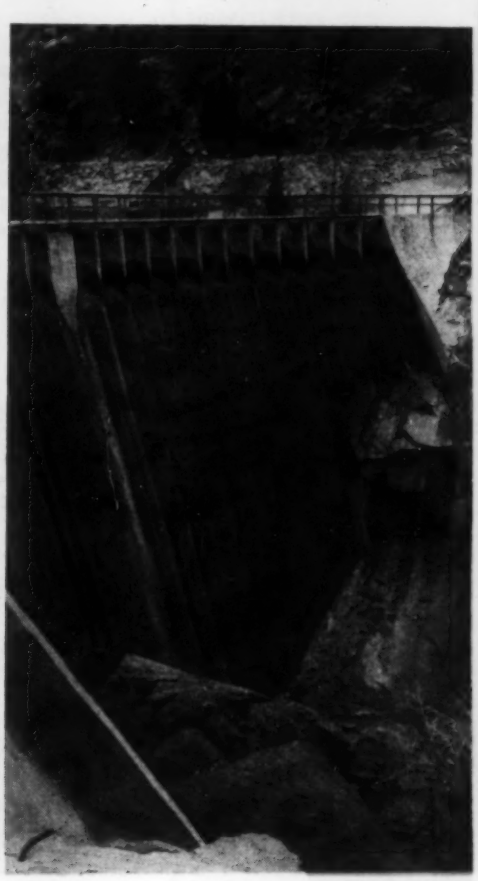
Damage from Internal Chemical Action

In Southern California there have been many examples of destructive expansion of concrete resulting from the action of alkali in the cement on certain types of aggregate, but the Company has been most fortunate in that there has been no damage to the concrete extensive enough to require repair, and such damage has all occurred in incidental structures.

One place where expansion has been noted is in the footings for a reinforced concrete flume on the Kern River. In this case the footings have shown heavy surface cracking but because of their small size the expansion has had no harmful effect on the structure as a whole. The footing concrete was made from a crushed phyllite aggregate. Fortunately, the remainder of the structure was made with aggregate com-

(*Continued on page 70*)

TO IMPROVE APPEARANCE of spalled and ragged downstream face of arched diversion dam after 28 years' service, all loose concrete is chipped from surface (below, left) and vertical drains of 4-in. half tiles are placed to intercept leakage. Workmen (below, center) fasten 3×3-in. No. 6 mesh reinforcement to 1/2 in.-dia dowels grouted into body of dam. Gunite layer is placed to average thickness of 5 in. After six years' service (below, right) face of dam is in excellent condition.



LITTLE SIOUX BASIN SERVES AS Miniature Mississippi Valley FOR Control Studies

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FLOODS OCCUR BECAUSE natural channels are not large enough to carry all the water they receive. It is obvious then that protection against floods can be accomplished only by reducing the amount of water that enters the rivers, or increasing the channel capacity, or both. Measures for reducing the water entering a river may consist of forestation, which creates a bed of humus that absorbs part of the rainfall; soil treatment by planting, contour-plowing and gully control, which also retards swift runoff to the streams; or creation of ponds and detention reservoirs. All these measures may keep water in the ground to some extent, either permanently or temporarily, or store it for future discharge, and thereby lessen the burden imposed on the tributary-stream and main-river channels. If these expedients do not completely control floods, the only remaining remedy is to increase the capacity of the flood channels. Efficacy of the various flood control measures, based on studies of the Little Sioux Basin in northwestern Iowa, are discussed in this paper.

MAJOR FLOOD CONTROL measures such as detention reservoirs and enlargement of the main waterway channels must still be resorted to, in spite of all that can be done to retain surplus water in the uplands, if we are to prevent flooding. Channel enlargement may be accomplished by removing obstructions, dredging deeper and wider channels, removing kinks and bends, creating additional floodways and outlets, and by building levees on the banks. All these measures, as well as detention reservoirs, are being provided in the present flood-prevention plan for the Mississippi River and other rivers.

Each method of control, whether it be by detention in the uplands or by channel enlargement, has its enthusiastic advocates who are prone to believe that their favorite remedy will obviate floods. Resulting from these enthusiasms is a widespread feeling that the various remedies, or partial remedies for floods are antagonistic to one another. Offsetting this opinion, there is a growing feeling that all the remedies have their proper place in an overall plan, that the treatments are complementary, not antagonistic, and that the objective should be a system whereby all the works that man can perform to protect himself against flooding should be developed to work together in accomplishing the great task.

Consider first the apparent conflict between those who believe that floods should be controlled by soil conservation and other flow-retarding measures at their source, and those who believe that excess runoff must be controlled not only at the headwaters, but also down in the valleys. There should be no conflict between these two schools of thought because it is obvious that all effective measures for retardation of flood waters in the uplands will lessen the burden placed on the protective works in the valleys, and that in spite of the most effective treatment of the uplands the lowlands may still be plagued by destructive floods.

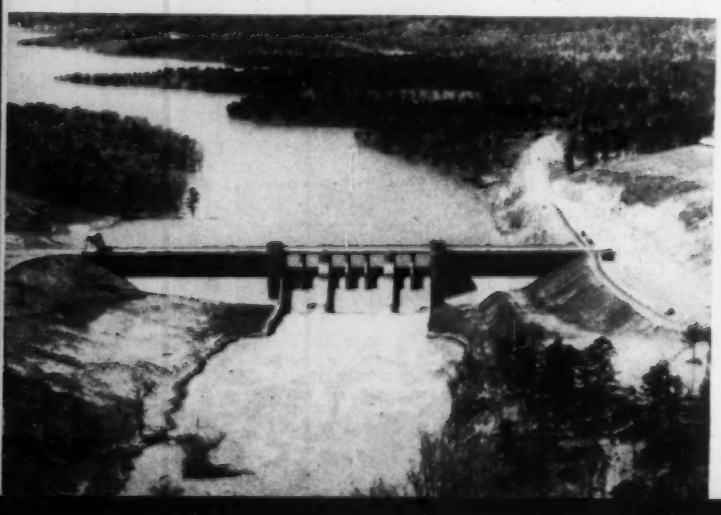
Little Sioux Basin Studied

It will help us in understanding this problem to examine a specific area in which all reasonable methods of flood control have been studied. The Little Sioux River basin furnishes an instance in which the treatment of soils and gullies to minimize erosion has been carefully related to more general methods of flood control. This river runs south from its source in northwestern Iowa to its junction with the Missouri River a few miles south of Sioux City, Iowa. The basin is oval in shape, roughly 120 miles long and 35 to 50 miles wide, with a drainage area of about 4,500 sq miles.

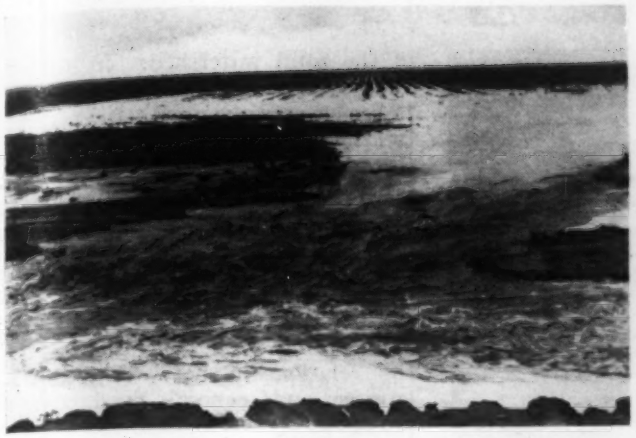
The soils in the central part of this valley are largely characterized by loess, a fine-grained, silty material, brought to the present location by wind action through many centuries. These soils are easily eroded and gullied when attacked by rainfall and running water. The lower part of the valley, between the bluff lines and the Missouri River, is alluvial and fine grained, but because it is quite level it is not subjected to the rapid velocities that cause erosion.

The Army Engineers are studying and working on a flood control plan for this portion of the basin. The area is very flat and is drained by a system of natural and artificial channels which are large enough to carry off the rains falling on the area itself, but are not large enough to dispose of local rain water combined with runoff from the hills. The maintenance of these channels is made difficult and costly by the silt resulting from erosion in the upper sections of the valley.

The problem to which the Army Engineers are directing their efforts is how to keep the ditches and streams from overflowing flood waters on the flat lands and ruining or injuring



DETENTION RESERVOIRS supplement other control measures in preventing floods and excessive soil erosion. Nimrod Dam on LaFave River, Ark., creates reservoir for detention of flood waters in Arkansas basin.



FLOOD DAMAGES to farmer in bottomlands—in which his soil is inundated for days or weeks but may gain in fertility—differ from those of upland farmer (left) who suffers considerable damage to his soil, fences and buildings from rapid discharge of flood waters over his lands. Arkansas farm (right) is protected from Mississippi River by levee.

crops, or seriously delaying spring planting. The details of their plan have not been announced, but it is reasonable to expect that the recommended measures may include straightening and enlarging the channels, constructing levees along the banks of the streams and ditches, and possibly building desilting reservoirs. Engineers who have viewed this area believe that these improvements, accompanied by reasonable patrol and clearing of the stream during ice jams, would provide protection from any floods such as have occurred since 1891. The works would probably cost several million dollars.

Soil Conservation Service Plan

Obviously, a flood control project of this magnitude would be unnecessary if all floods could be obviated by suitable soil conservation treatment in the uplands to make them retain the water and keep it from rushing down to the bottomlands.

The U.S. Soil Conservation Service has prepared a plan which consists of farm-land treatment by individual farmers. It is based upon plans to be furnished by the federal government for minimizing runoff and erosion, and a publicly financed program for control of those gullies which are so large that they cannot be checked by individual private action. The report recommends the following measures for reducing flood runoff and erosion by increasing both the amount of storm rainfall taken into the soil and the amount of water that can be temporarily stored on the land surface.

"1. Increasing the area devoted to protective vegetation such as pasture, grasses, woods and hay, with a consequent decrease in the acreage of clean-tilled crops.

"2. Improving the quality of the vegetal covers to increase infiltration and decrease erosion.

"3. Minimizing the runoff and erosion from lands remaining in cultivation by use of supplementary measures such as terracing, contour cultivation, and soil improvement."

"Much of the increase in protective cover," the report continues, "will be brought about by the use of crop rotations under which the land will be occupied by close-growing covers a greater percentage of the time. The rotations contemplated vary from a corn-corn-oats-meadow sequence for the gentle slopes of Zone 2, to a rotation of corn-oats-4-years-of-meadow for the steeper lands of Zone 4. A further decrease in the acreage of clean-tilled crops will be obtained by placing permanent protective covers on slopes too steep for any form of cultivation, using them for pastures or wood lots. During the dormant seasons the area in close-growing vegetation will be increased by the use of winter cover crops.

"The program will improve the quality of the protective covers through the renovation and proper management of pastures; the improvement of wood lots by planting, management, and protection against grazing; and the improvement of close-growing crops through the increase in fertility brought about by proper rotations. Supplementary measures for improving and preserving the quality of cover on land permanently devoted to grass or trees will include contour furrowing, gully control, and waterway protection.

"The supplementary measures used to minimize the runoff and erosion from the lands to remain in cultivation will include: Contour cultivation, terracing, waterway protection, gully control, proper use of crop residues and the institution of improved management practices."

CONSTRUCTION OF LEVEES on banks of streams is one method of channel enlargement provided in present flood-prevention plan for Mississippi River. Here, 10-yd and two 8-yd Heil scrapers powered by International TracTracTors construct levee under U.S. Army Engineers contract near Memphis, Ark.

PARTIALLY COMPLETED LEVEE along Illinois River is sand-bagged during flood to protect low lands. Effective measures for retarding flood waters in uplands lessen burden on protective works in valleys.

COMPREHENSIVE CONTROL PLAN for Mississippi River includes channel improvements by clearing, straightening and dredging. Black gumbo from borrow pit on river side of levee is mixed with small percentage of clay and sand for levee construction.

The Soil Conservation Service does not make any extravagant claims as to the effect its project will have on reducing or eliminating floods. It finds that the effect of its farm-land treatment program in reducing areas inundated will be as indicated in Table I.

The Soil Conservation plan, therefore, is designed primarily to conserve upland soil, reduce sedimentation both on bottomlands and in drainage ditches, and retard runoff. As can be seen by Table I, the reduction in overflow brought about by watershed treatment varies from 9.75 percent on the Little Sioux itself, where approximately half of the watershed is being treated, to a maximum benefit of 37.5 percent on the Maple River, where the entire watershed is being treated. Thus as we move downstream—out of the smaller valleys into the larger ones—we find that the soil conservation program will protect smaller and smaller proportions of the total watershed. In all the valleys, large and small, soil conservation measures, even with 100 percent treatment, leave large areas unprotected from floods. The upstream program of soil conservation in Little Sioux Valley dovetails into and simplifies general flood control problems but does not remove them.

TABLE I. SUM OF AREAS INUNDATED BY ALL FLOODS IN EVALUATION SERIES

Stream	Without Treatment (Acres)	With Treatment (Acres)	Percentage Reduction
Little Sioux . .	312,421	281,962	9.75
Maple	116,915	73,196	37.5
West Fork . .	50,355	38,028	24.5
Elliott	11,622	8,527	26.5

The Mississippi River Valley

Accepting these conclusions as to the relationship between the soil-erosion and general flood control measures for the Little Sioux Valley, let us consider to what extent they can be applied to floods in the major valleys—say the valley of the Mississippi River, which contains hundreds of valleys such as the Little Sioux, as well as a vast area of bottomlands directly tributary to the main stem. Let us assume that soil-erosion practice and other water-flow retardation measures have been applied over this great basin extending from the Rockies to the Alleghenies and from the Great Lakes to the Gulf. In 1927, waters falling on this vast valley united to form a great flood of the Mississippi River which went out of its banks, becoming a flood stream 50 miles wide. It covered millions of acres of fertile lands and drove hundreds of the occupants out of their homes.

If it is assumed that the Little Sioux Valley is a miniature of the Mississippi Valley and that soil treatment measures for the latter would be required in proportion to the area, what might we expect to accomplish?

Accomplishments Estimated

The Little Sioux Basin contains 4,500 sq miles. The area bordering the main stream that is subject to flooding is estimated to be 312,000 acres. With a total expenditure of $2,777,000 of federal and local funds on half of the watershed, the Soil Conservation Service estimates that the flooded area could be reduced to about 282,000 acres, a reduction of 30,000 acres, or slightly less than 10 percent.

The area of the Mississippi River basin is $1\frac{1}{4}$ million sq miles, roughly 300 times the area of the Little Sioux Basin. If expenditures for soil treatment over the entire basin were in like proportion they would amount to over 800 million dollars. This would not be too great a sum to pay for complete flood protection. It is probably not too much to pay for the great local benefits that would result from conserving the soils. But the area subject to floods in the alluvial valley of the Mississippi River is

about 30,000 sq miles. Granting that soil protection measures in the uplands might reduce the flooded area by 10 percent, there would still be a serious flood problem on the remaining 27,000 sq miles. Means other than soil treatment must be found for obviating the vast lower-valley floods whose devastating effects react on all parts of the nation.

Channel Improvements

The ultimate comprehensive plan of the Army engineers for flood control of the Mississippi River Valley comprises channel improvements by clearing, straightening and dredging; floodways that will add their capacity to that of the main river; levees that will prevent spreading of flood waters after they rise above the natural banks; and reservoirs that will temporarily hold tributary waters out of the main stream until they can be discharged without overtopping the levees. The plan is a big one, which will require many years for completion. That it will eventually be successful is demonstrated by what only a partially completed plan has accomplished. In 1937 a mammoth flood, originating in the Ohio, Arkansas and other river basins swept down the Mississippi River with almost the same potential for destruction as the 1927 flood. But instead of levee after levee popping, as happened in 1927, the partially completed project contained the flood waters in 1937 and conducted them to the Gulf without serious damage. This demonstration should convince us that when the projects for control of floods in the main river and the many component tributary valleys are completed, a very large part of the suffering and devastation we have experienced in the past will be obviated.

Army Engineers Administer Plan

The general flood control plan is being administered by the Army Engineers under mandates from and plans approved by Congress. Increments to the general plan are being added from time to time and it is probably no more possible to visualize at this time what the ultimate nation-wide flood control plan will be than it would be to blueprint the future highway and airway transportation systems. The projects now approved and envisaged throughout the United States amount to several billions of dollars, but their development will afford almost complete protection against floods. Watershed treatment such as is starting on the Little Sioux will serve to bolster up and protect this vast and necessary downstream program of the Army Engineers.

Upland Control Important

Conservation of soil, water-flow retardation, and reduction or elimination of erosion in our upland valleys are most important if we are to avoid annual blighting of hundreds of square miles of tillable lands and the impoverishment of the farmers who live on them. Not only will this type of conservation benefit the citizens who are struggling to make these lands yield them a living, but by detaining a portion of the excess flood waters and by retarding the erosion of silt which later encroaches on the capacity of the larger waterways, it will lessen the general problem of flood control.

The two types of projects are necessary—neither one is a substitute for the other and neither one interferes with the other.

FWA Reports Progress on Fully-Planned State and Local Public Works

SUBSTANTIAL PROGRESS has been made toward achieving a reserve of fully planned state and local public works, ready to be put into construction when economic conditions warrant, according to a Federal Works Agency survey. This reserve is being slowly increased through the concerted efforts of state and local governments and the federal government. In order, first to bring the shelf of state and local public works up to an adequate volume (CIVIL ENGINEERING, November 1946, page 486), and then to maintain it in adequate volume as a continuing reserve, the report concludes, continued planning will be needed.

The results of state and local advance planning of public works, with and without federal assistance, are shown in the third semiannual report of George H. Field, commissioner of the Bureau of Community Facilities, FWA, which was made public on February 10 by Maj. Gen. Philip B. Fleming, Federal Works Administrator.

Through December 31, 1946, the report shows, under the advance planning of the Bureau of Community Facilities, a total of $46,606,763 had been advanced to 3,231 different public bodies, ranging from state governments and major cities to counties, townships, independent school districts and other public agencies. These public bodies, located in every state, the District of Columbia, Alaska and Hawaii, are using the advances to finance the preparation of drawings and specifications for local public works with an estimated construction cost totaling $1,529,211,000 and an estimated total cost of $1,832,913,000.

Commenting on the report, General Fleming said: "It should be emphasized again that advances made under this planning program must be repaid, without interest, when the projects so planned go into construction, and more than a quarter of a million dollars so far advanced has been returned to the federal treasury. Since all the advances are recoverable, there is no ultimate cost to the federal government beyond the small sums required for administration."

Advances Made to Many Public Bodies

The public bodies to which advances have been approved include 29 state governments, 298 counties, 2,256 cities, townships and towns, 596 school districts and 52 special districts of various kinds. Of the cities, townships and towns, 1,188 have populations of less than 2,500, 639 are between 2,500 and 10,000; 226 are between 10,000 and 25,000; 90 are between 25,000 and 50,000; 45 are between 50,000 and 100,000, and 68 are cities of more than 100,000 population. In the Bureau's advance planning program, intra-state quotas have been used to extend planning more and more into the smaller governmental units.

Plan preparations completed without federal financial assistance through December 31, 1946, cover proposed state and local public works with estimated construction costs of $1,323,498,000 and estimated total costs of $1,581,260,000. The reported increase in completed plan preparations during 1946 was $538,827,000 and during the six months ending December 31, $197,709,000—both in terms of construction costs. A third of all planning completed without federal financial assistance is in New York State, compared with about half in that state a year ago.

In addition, without federal financial assistance, state and local gov-

(*Continued on page 71*)

Light-Weight Trucks Increase Pay Load

TRUCKS USED FOR CONSTRUCTION comprise a large percentage of those being produced at this time. Therefore any comments pertaining to production of trucks in general are applicable to the equipment many construction companies will have on their jobs in the near future.

To prophesy on trends in truck design and construction, it is necessary to understand a few of the problems involved. Five million trucks perform countless services in America each day. One hundred thousand trucks are used in mining and lumbering and 431,000 in construction work. World War II, the roughest war we have fought, was won by trucks—by trucks and the personnel and equipment hauled by trucks.

Great Demand for New Trucks

At the moment our truck builders are in the midst of a necessarily dual task. Much planning of postwar models was done during the war years, but no one was actually prepared for the abrupt ending of the war when it came. Suddenly the need was not for trucks for tomorrow, but trucks for today. The average truck on our roads was then $7^1/_2$ years old; 2,000,000 trucks, run during the war till the wheels dropped off, needed replacement at once.

How has the industry been doing on this first part of the task? What with strikes and parts shortages the answer is, only medium. In July of 1945 the WPB told the trucking industry that it could turn out 548,172 commercial trucks during 1945. Telling is one thing, doing is another. In reality it turned out approximately 316,000 commercial trucks during the year. By December its production was supposed to be up to 90,000 new trucks a month; actually it was about 30,000. In 1946, with the strike situation easing and reconversion out of the way, the truck industry finally began to approach the all-time record production of 1,000,000 trucks a year. It must maintain this for several years to catch up to the nation's needs.

Light-Weight Trucks

A trend toward lighter trucks is expected, since the economic principle involved is sound. Every state has a gross weight limit for its highways, and a ton removed from the truck weight is a ton added to the pay load.

A study of the problems involved in making a light-weight truck indicates that there is no simple solution to the task. First, the weight and cost of the available materials vary at an inverse ratio. Taking magnesium as a weight of 1, aluminum would weigh roughly $1^1/_2$, the new alloy and heat-treated steels $2^1/_4$ to $3^1/_3$, and regular commercial grade steel approximately $4^1/_2$. (The new alloy and heat-treated steels weigh the same per cubic foot of metal as ordinary steel, but, being stronger, can have a lighter section.) The approximate cost per pound at present, in the same order as above, is 20.5, 15, 3.7, and 2.5 cents. The result is obvious. Our trucks, therefore, have been built largely of steel.

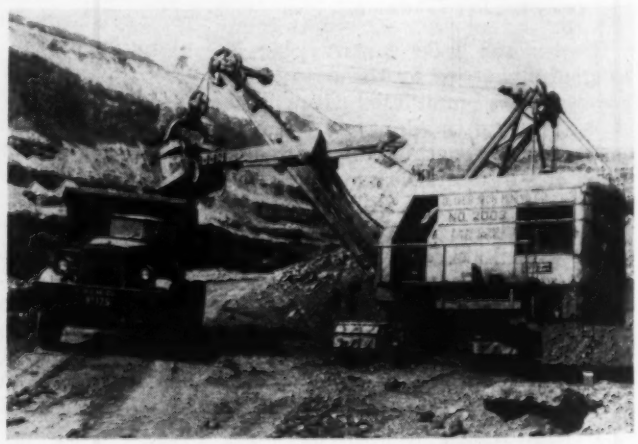
Where a truck is run continually at capacity loads, a lighter-weight truck will pay for itself. However, use of the lightest metal—even though the extra cost is not a deterrent factor to the buyer—does not always give the lightest finished product. Each metal has its inherent characteristics; one may nullify the other.

Magnesium, although the lightest of the metals under discussion, is more difficult to fabricate and has less resistance to corrosion than either aluminum or steel. Aluminum, while having good resistance to many types of corrosion, has little resistance to abrasion or blows. Aluminum also has a low fatigue strength. A differential gear made of aluminum would be approximately four times as large as the present steel gear of equal strength, and thus would actually weigh more. The same principle applies to countless other parts.

State Laws Vary

Progress has been made in improving conflicting state trucking laws, but much more work is needed to obtain even greater uniformity. Lengths allowed on a single truck without trailer range from "no restriction" in two states to $26^1/_2$ ft in another. Weights vary from 77,600 to 31,000 lb. One state decrees that a truck horn must be heard for 600 ft. Some states insist on different colored clearance lights. There are only three states that demand a workable steering gear.

No matter what miracles truck designers and manufacturers perform, the real future of the American motor truck will still depend on the thing it has always needed—a clear, safe, adequately designed highway for long hauls—*American Iron and Steel Institute.*



OVER 10 PERCENT of the five million trucks performing countless services in America each day are used for construction. Truck industry, which is beginning to approach all-time record production of one million trucks a year, shows trend toward lighter weights and increased pay loads.

Engineers' Notebook

Method Determines Degree of Fixity in Footings and Resulting Frame Stresses

A. FLORIS
Los Angeles, Calif.

RIGID FRAMES ANALYZED AS FIXED at the base are not common in practice because of the doubt regarding the degree of fixity of the footings. It is usually assumed that a frame is hinged at the base, but no provision is made in the design to provide for this condition. The assumption is of course not quite correct, if the frame and footings are not designed to resist a certain amount of fixity. A method is here presented for determining the degree of fixity in footings and the influence such footings exert on the stresses in the frame.

Induced Moments Caused by Eccentric Loading

In an economical design the entire bearing area, bc of the footing in Fig. 1 (a), must be under pressure. The limiting case is obtained when the resultant acts at the third point. The triangular pressure diagram, Fig. 1 (b), is produced by superimposing the pressure diagram, Fig. 1 (c), for a centrally loaded footing, and the compression and tension diagram, Fig. 1 (d), due to the eccentricity of the

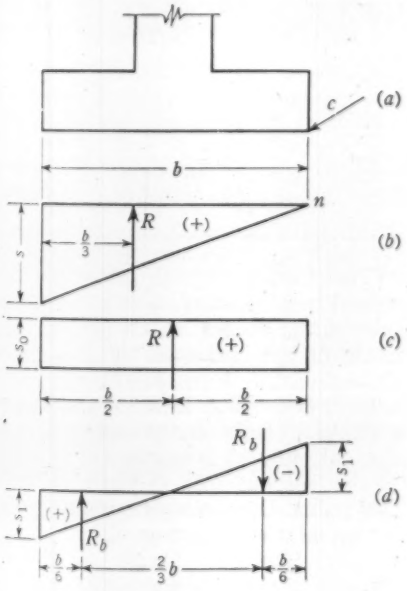


Fig. 1. Pressure Diagrams.

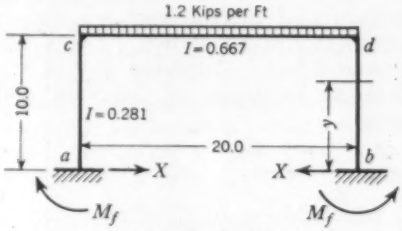


Fig. 2. Completely Fixed Frame.

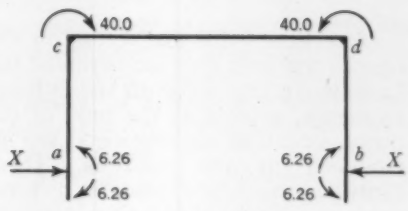


Fig. 3. Partially Fixed Base Frame.

reaction R. Hence the vanishing of the pressure at point n means that s_1 equals s_0 and consequently that

$$s = 2s_0 \quad . \quad . \quad . \quad . \quad . \quad (1)$$

where s is the allowable soil pressure and s_0 the pressure due to a centrally loaded footing. The dimensions of the rectangular bearing area of the footing are determined by using a soil pressure, s_0, obtained from Eq. 1.

By inspection of Fig. 1 (d) and use of Eq. 1, the resisting footing moment, M_i, caused by two equal and opposite forces R_b, is determined as:

$$M_i = \frac{scb^2}{12} = \frac{pb^2}{12} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

The footing moment therefore is equivalent to the fixed-end moment of a beam of span b, loaded with $p = sc$, where c = width of footing.

Substituting the ratio $a = c/b$ and denoting by m the degree of fixity at the base of the frame, the equation expressing the equilibrium of footing and frame moments will be:

$$\frac{asb^3}{12} = mM_f = M_i \quad . \quad . \quad . \quad (3)$$

or the degree of fixity,

$$m = M_i/M_f \quad . \quad . \quad . \quad . \quad . \quad (4)$$

and the length of the footing,

$$b = \sqrt[3]{\frac{12M_i}{as}} \quad . \quad . \quad . \quad (5)$$

in which M_f is the partially fixed or induced moment.

Herein it is assumed that the horizontal thrust of the frame is resisted by a tie-rod, or that the moment in the footing caused by this thrust is small and can be neglected.

In well-proportioned footings it can be assumed that $a = 0.625$ approximately.

The limiting cases, Eqs. 3 and 4, are for complete fixity of frame if $m = 1$, and for a hinged frame if $m = 0$. The vanishing of Eq. 4 means that, in the absence of moment at the base of the frame, the footing is loaded centrally.

For given allowable soil pressure and footing dimensions, Eq. 3 furnishes the maximum value of fixity that can be resisted by the footing. On the other hand, the required footing dimensions can be determined by means of Eq. 5, if the degree of fixity of the frame is given. Equation 5 can be utilized also in case the induced moment is replaced by the moment of complete fixity. In fact, this expression is equally useful in the direct design of eccentrically loaded footings.

From the above reasoning and Eq. 1, it follows also that footings designed for hinged frames, centrally loaded but provided with incomplete hinges, are objectionable if the design soil pressure is assumed to be *greater than half* of the allowable.

Frames Subjected to Induced Moments

When the frame is analyzed in accordance with the classical methods, the moments of complete fixity in the elastic equations are replaced by the induced moments. Thus, the terms that are functions of the induced moments are known quantities applied as external loadings, and the number of the elastic equations is reduced by the number of these moments.

In applying the moment distribution method to the problem at hand, the following procedure may be used to advantage.

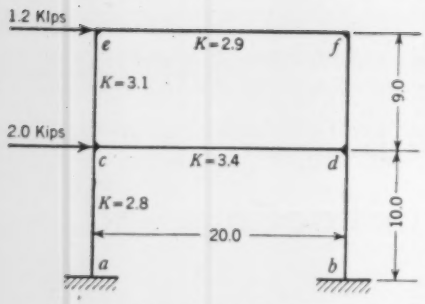


Fig. 4. Two-Story Fixed Frame.

If vertical loads are acting on the frame, the fixed-end moments of the loads in conjunction with the induced moments, applied at the base of the frame as cantilever moments, are introduced in the analysis. These cantilever moments rotate in a direction opposite to that of moments of fixity. After these moments have been applied, their distribution follows the usual procedure.

In case of lateral loads, the induced moments at the base of the frame are applied as cantilever moments. This is analogous to the previous case of vertical loads, with the difference that the induced moments rotate in the opposite direction. The distribution method is employed in applying these cantilever moments at the top and bottom of columns in each story separately, using moments proportional to the stiffness factors, or simpler, the stiffness factors themselves. In the case of columns of equal section and height in a story, the applied moments can be arbitrary but must be equal at top and bottom. As is well known, the number of equations thus obtained, is equal to the number of stories. The equation pertaining to the lowest story, however, is formed differently from those derived for the remaining stories. The equations referring to the upper stories are determined in the usual manner ("Analysis by Moment Distribution Aided Through Use of Iteration," by A. Floris, *Engineering News-Record*, June 25, 1936, page 922). The right-hand part of the equation for the lowest story is the story moment less the induced moments. The unknowns in these equations are the proportionality or equilibrating factors of the stories. Excepting the induced moments, all other distributed moments are multiplied by these factors.

Numerical Applications

The symmetrical and symmetrically loaded frame, Fig. 2, is completely fixed at the base. Loading, moments of inertia and lengths of members are as shown. Units are kips and feet. Applying any of the classical methods of analysis and using

$$M = M_0 - Xy + M_f$$

in which M_0 = moment of statically determinate base frame, and X = horizontal thrust at the base of the frame, the following elastic equations for half of the frame are derived:

$$1{,}511.00X - 184.40M_f = 3{,}376.0$$
$$-184.40X + 28.44M_f = -337.0$$

from which $M_f = 12.52$ kip-ft and $X = 3.74$ kips.

Assuming $m = 0.50$, then $M_i = 0.50 \times 12.52 = 6.26$ kip-ft, and the elastic equation will be

$$1{,}511.00X = 3{,}376.0 + 184.40 \times 6.26 = 4{,}536$$

Hence $X = 2.99$ kips.

Using the moment distribution method, the cantilever and fixed-end moments, Fig. 3, are 6.26 and 40.00 kip-ft, respectively, from which, after seven cycles of distribution, the final moments, $A_e = -6.26$ and $C_e = -23.72$ kip-ft, are obtained. The horizontal thrust is $X = 1/10.0\ (6.26 + 23.72) = 2.99$ kips, which is the same value as before.

The final joint moments of the completely fixed, 50 percent fixed, and two-hinged frames, Fig. 2, are given in Table I.

TABLE I. MOMENTS OF THE TWO-LEGGED FRAME

Mark	Degree of Fixity		
	Complete	50%	Hinges
A_e	−12.52	−6.25	0
C_e	−25.07	−23.72	−22.40
C_d	+25.07	+23.72	+22.40

The two-story frame, Fig. 4, is completely fixed at the base and subjected to horizontal forces of 1.2 and 2.0 kips.

The lengths and stiffness factors of the members of this symmetrical and antisymmetrically loaded frame are as shown.

For half of the frame, the story equations in this case are:

$$45.03x - 9.61y = 16.00$$
$$-9.64x + 34.25y = 5.40$$

from which the equilibrating factors, $x = 0.414$ and $y = 0.273$, are obtained. Hence, the moment of complete fixity at the base will be $A_e = 9.26$ kip-ft.

Taking 50 percent of the above value and applying this induced moment, $-0.50 \times 9.26 = -4.63$ kip-ft, and the arbitrary moments 10.0 kip-ft, as indicated in Fig. 5, after four cycles of distribution the following story equations for half the frame are derived:

$$5.78x + 0.15y = 11.37$$
$$-2.68x + 10.00y = 5.40$$

in which $11.37 = 16.0 - 4.63$. Solving these equations, the equilibrating factors are $x = 1.94$ and $y = 1.06$.

The final joint moments of the frame, Fig. 4, completely fixed, 50-percent fixed, and hinged at the base, are given in Table II.

TABLE II. MOMENTS OF THE TWO-STORY FRAME

Mark	Degree of Fixity		
	Complete	50%	Hinges
A_e	+9.26	+4.63	0
C_a	+6.77	+11.36	+16.00
C_d	−8.74	−12.78	−16.96
C_e	+1.97	+1.42	+0.96
E_c	+3.40	+3.94	+4.45
E_f	−3.40	+3.94	+4.45

The frame, Fig. 2, has been designed by assuming, but not actually providing, hinges at the base. Because of the action of the horizontal thrust of 3.0 kips, the vertical reaction, $R = 23.0$ kips, of this frame shifts 0.26 ft from the center line of the column. By moving the center of the bearing area of the footing to this point, the moment caused by the action of the thrust is almost eliminated. However, if a tie-rod is used, the shifting is unnecessary.

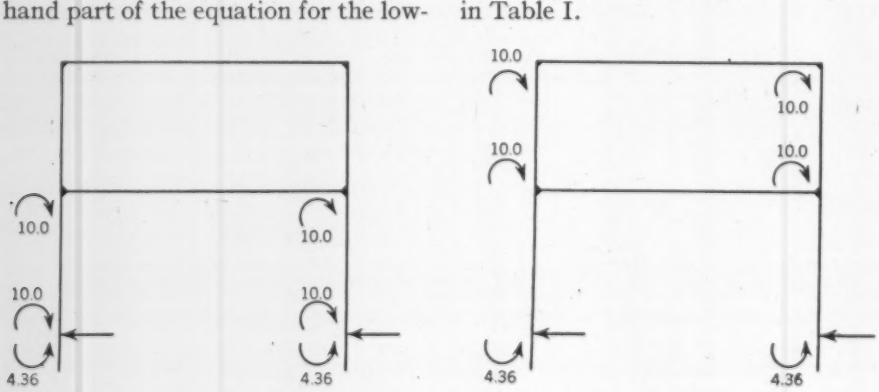


Fig. 5. Partially Fixed Base Frame.

(*Continued on page 71*)

...THE READERS Write

Metropolitan Juniors Have Class in Public Speaking

TO THE EDITOR: In reference to your recent editorial, "Why Technical Tedium?" in which you suggest that groups in Local Sections of the ASCE form self-improvement public speaking clubs, through Toastmasters International or otherwise, you may be interested in knowing what our group, the Junior Branch of the Metropolitan Section, is doing to make its members effective speakers. This is accomplished through a public speaking class which meets every Monday evening from 7 to 9 p.m. in the ASCE Board Room at 33 West 39th Street. The class is open to all members who are interested in becoming effective speakers. There is no charge for the course.

The class is conducted by a young civil engineer who has made a hobby of the study of effective speaking for eight years. The hobby has led him to the study of elocution, public speaking, conference leadership, and radio speaking. In the course, the instructor presents the results of his extensive research on the subject. The subject is given on a scientific basis as an analysis of the equation for effective speaking: $M = B+H+V$, in which M is the Mind, B is the Body, H is the Heart or emotions, and V is the Voice of the speaker. The equation, which was developed as a result of the instructor's analysis of all the phases of public speaking, is used in the course to develop the laws of effective speaking and produce a good speaker.

The first hour of the Monday evening class is devoted to laboratory work, which includes a lecture on the laws of effective speaking and exercises to develop the law. The second hour is the workshop hour. During this period five-minute talks are delivered by the students. Constructive criticism is then given each student, with attention to the good and bad aspects of the presentation and to places in the talk where application of the law of effective speaking might have been made to advantage. The student is finally given an opportunity to apply his knowledge by presenting a ten-minute talk at a Junior meeting.

CIVIL ENGINEERING is to be congratulated for its courageous pointing up of this glaring weakness, or stigma, that marks the engineer. Let us hope that more and more Local Sections will sponsor public-speaking groups.

Before closing, I want to extend a cordial invitation to all members to attend our class in effective speaking.

MICHAEL YATSKO, Jun. ASCE
Chairman, Public Speaking Committee, Metropolitan Section, Junior Branch
New York, N.Y.

Use of Aeronautical Data Advised in Bridge Tests

TO THE EDITOR: In his article, "Simple Model Tests Predict Aerodynamic Characteristics of Bridges," in the January issue, Dr. D. B. Steinman urges additional wind-tunnel tests of models of suspension bridge cross sections. While much engineering study of the aerodynamic stability of suspension bridges has been made since the Tacoma Bridge failure, the time and money spent on this research have been small compared to that spent on similar studies of military aircraft, where the use of million-dollar wind tunnels is almost commonplace. It seems unfortunate that more public funds are not available for comprehensive model tests of suspension bridges under static and dynamic conditions.

The deflection theory for suspension bridge analysis—first applied to the Manhattan Bridge in 1909—permitted the use of lighter and more flexible stiffening trusses than were required by the common elastic theory. Subsequent developments and applications of this theory, by Dr. Steinman and others, permitted further weight reductions in the stiffening truss to perhaps 10 percent of the weight indicated by the older method of analysis. Without this progress in suspension bridge engineering many existing long-span bridges would not be economically feasible.

The ill-fated Tacoma Bridge was by far the most flexible and most economical bridge of comparable span. If it had been stable aerodynamically, it would have represented great progress in bridge engineering. With a thorough understanding of the problems of aerodynamic stability, it is probably possible to build satisfactory suspension bridges that are even more flexible than the Tacoma Bridge. If further progress is to be made, a workable theory of aerodynamic stability must be established and verified by extensive tests. If stability is provided by reverting to heavy stiffening trusses rather than by scientific analysis and design, bridge engineering progress will be retarded 20 or 30 years.

Wind-tunnel pressure measurements on models of bridge cross sections, as proposed by Dr. Steinman, would contribute valuable information which is not now available. However, several discussers of Dr. Steinman's original paper believe that the problem cannot be completely solved from data on a motionless model, and that aerodynamic effects of the oscillations must be further considered. Dr. Steinman's theory, for example, fails to explain why certain cross sections, which he classifies as torsionally and vertically stable, may oscillate under certain conditions. An airplane wing always has lift and moment curves of positive slope but may oscillate, or "flutter," after the wind velocity exceeds a critical value.

According to Dr. Steinman's theory, the suspension bridge is assumed to vibrate with only one degree of freedom. The vertical oscillation is considered separately from the torsional oscillation, with no coupling effects. For stable cross sections, such as airplane wings, it can be shown that there is no input of energy from the air if the system has only one degree of freedom. Pure torsional oscillations or pure vertical oscillations are soon damped, regardless of the wind velocity. When the structure oscillates with two degrees of freedom, such as simultaneous vertical and torsional oscillations, there may be an input of energy from the airstream to the oscillating structure, which quickly builds up large amplitudes of vibration. This condition can easily exist in suspension bridges with so-called "stable" cross sections. As the bridge deck moves upward it is twisted so that the lift force is upward, while as it moves downward it twists to a negative angle of attack and the force is downward. Thus, considerable work is done on the structure during the cycle of oscillation. The flutter theory has been extensively developed for airplane wings and can be applied to suspension bridges.

While "stable" cross sections cannot oscillate with one degree of freedom, "unstable" sections such as ice-coated transmission lines or suspension bridges with d/b greater than 0.24 can experience ver-

tical oscillation with one degree of freedom. This theory of vibration is well established and has been proved by experiment. Dr. Steinman's equations, showing an input for torsional oscillations with one degree of freedom, are not well established. His concept of a phase difference between the aerodynamic forces and the angular motion is based on observations of the vibration of actual bridges and models. It is possible that the structures observed actually had some vertical motion, and that the energy input was the result of this motion with two degrees of freedom. Dr. Steinman's theory of torsional oscillations might be verified by wind-tunnel tests of section models which are oscillated in rotation only. A cross-section model can be given rotational oscillations in the air stream by means of an electric motor, and the power input or output measured electrically. This method has been used satisfactorily in the study of airplane wings.

Flexible suspension bridges would be safe for oscillations with one degree of freedom if they were provided with open trusses and aerodynamically stable cross sections. Safety for oscillations with two degrees of freedom might be obtained by means of a few cable stays arranged so that they would make the structure more rigid torsionally but would not stiffen against vertical deflections. The vertical flexibility is desirable if full advantage is to be taken of the deflection theory in reducing the weight of the stiffening truss. If bridges with the flexibility of the Tacoma Bridge could be made safe by such minor design changes, millions of dollars could be saved in future construction. The problem certainly warrants additional study and research which will utilize the progress that has been made in the related field of aerodynamical engineering.

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Pennsylvania State College
State College, Pa.

Compensation Affects Quality of Educators

TO THE EDITOR: A dispassionate and thorough look at the economics of education in America discloses disturbing facts. More men are clamoring for professional and academic instruction than ever in the history of the world. Our government has generously offered college training to the veterans of the recent war, so that our universities and colleges and technical schools are overflowing with eager students. We are hard put to give them classrooms, and the teaching staffs have a tremendous amount of work ahead.

Then there is the matter of the graduate's salary after he has won his degree and gone to work. His salary is often larger than that of the instructor who taught him the science that lands him his job! Don't think that the teachers are not aware of this, and of the patent injustice of it. A wave of unrest among teachers—almost protest, I could say—is evident. So the professor quits his underpaid job of teaching and becomes a well-paid professional man in the realms of business or engineering or industry.

In the interest of justice and economic common sense, it seems to me that the learned teacher who launches thousands of young men on lucrative careers, deserves even greater remuneration that the most successful of his students can earn. Instead, the present scale of most professional pay is so ridiculously low as to dishearten even the most devoted educator, so that it is little wonder that more and more teachers leave the classroom for the industrial laboratory or the active field positions.

It is a sad and bitter commentary on our attitude toward higher learning that we are willing to pay good salaries to graduate engineers, but fail to express appreciation of the educator's worth. Imagine a civilization, eager for higher education, that pays a factory trainee, at the end of six months, more than it hands in salary to a highly educated, competent teacher. Furthermore, living costs are greater for the teacher than for the industrial worker.

It also happens that many federal jobs requiring the same specialized skills needed for teaching are inadequately paid. The result is that men of lesser ability are all that the government can get to fill the positions. Perhaps our universities should take warning from that. When our competent teachers, one by one, lose patience with insufficient income, and leave their positions, who but the less qualified men will be available as teachers? Lowered standards of teaching, as I have pointed out, mean lowered grades of work in engineering, and the world will suffer thereby.

I do not question the right of the man in overalls to whatever top pay he can earn, if he gives value received. He is worthy of his hire as any other worker, whether professional or non-professional. But I do question the justice and wisdom of a public viewpoint that denies the teacher the pay received by the manual worker, who requires no skill beyond the routine of the machinery he tends. If we are to develop universal education on a plane of comparative equality, we must pay our instructors salaries that more equitably reflect their skill and ability.

Personally, I do not think that the remedy for this imbalance lies in nationally subsidized or "socialized" institutions of learning. State colleges as we know them are excellent. But government experiments with regimentation of industry and business indicate a perilous course for education if applied to schools and colleges. Regimentation too quickly brings all effort down to one dead level—often a level of mediocrity, because individual inspiration and enterprise are curbed and futile. The fate of future educational effort, in the face of mounting losses of great men from our faculties, is dark enough now. Federal administration might finish the debacle; we would have no big men left in our university chairs.

Perhaps the years will bring us to a better understanding of the true worth of the educator, and our grandchildren will seek not for lawmakers as guardians of the public welfare, but creative teachers. It is possible that a future generation will see the teacher in his true light, and submit to knowlege as the guide to truth. If our grandchildren can achieve peace and order with the help of free and universal education, then will the teacher appear as the priceless member of government and civilization that he is.

L. H. BERGER, M. ASCE
Boston, Mass.

Biographies Are Needed for New Who's Who

TO THE EDITOR: In 1941 the Lewis Historical Publishing Co. issued the fifth edition of *Who's Who in Engineering*. In so far as lists of engineers' names could be obtained, all engineers were requested to send the publishers a short biographical sketch for inclusion in the publication, and a total of approximately 15,000 engineers responded. The invitation for biographical material clearly stated that no obligation to purchase was involved.

The writer has found this list of biographical sketches in constant demand in the office and among engineers and public officials who know of its existence. When a question arises as to the education, training, and engineering record of a man, there is generally need for an immediate answer to the question, and in many cases the availability of such data is to the material advantage of the one whose record is sought.

This letter is for the purpose of urging the engineering profession, as a whole, to take advantage of the opportunity to send in biographical sketches for the forthcoming sixth edition of *Who's Who in Engineering*.

E. N. NOYES, M. ASCE
Corpus Christi, Tex.

SOCIETY NEWS

EDITORIAL:

Let's Put It to a Vote

"FOR IMMEDIATE and earnest consideration and prompt action," were the words used by ASCE's new president, E. M. Hastings, in commending to the corporate membership the matter of enfranchisement of Juniors and a proposed increase in dues.

There were other references in his inaugural address (CIVIL ENGINEERING, February 1947, page 91) accentuating the time element in consideration of these matters which he characterized as "affecting the very life and growth of the Society." He expressed confidence that the momentum for the required constitutional amendment ballots "will be forthcoming—and soon." He linked the proposals with "our own particular times and the program of expansion now under way within the Society." His talk was punctuated further with such phrases as "the decision . . . cannot be deferred," "decision should be made without delay," and "the question . . . requires action."

Awareness of the time needed for effectuating the democratic process of advancing to ballot the constitutional amendments required by such proposals is an important factor in the "earnest consideration" each member should give to the two proposals. With the Society operating on a budget estimated to result in a deficit of some $56,000 during the current fiscal year, and with its cash reserves amounting only to about $60,000, it is patently imperative that an early decision be reached as to whether dues shall be increased or activities of the Society curtailed. Even if deficit financing were not unworthy of the engineering profession, the mathematics make it clear such practice would be impossible for any appreciable period.

President Hastings stated the case clearly:

"The outgoing Board of Direction has suggested an increase in dues of $5 per year for corporate members and $2.50 per year for Junior members" and it is our duty now to determine "whether to continue our growth as an organization or to curtail our activities, because 1921 dollars just cannot be stretched to cover today's operations, a quarter of a century after dues were last increased."

Petitions already are in circulation in each of the Society's four zones, from each of which must emanate 75 signatures requesting that each of these major issues be sent to ballot. The earliest time at which such amendments could be considered is at the Summer Convention in July, with an ensuing ballot among corporate members to be canvassed in October. Thus, an amendment authorizing the increase in dues would not provide additional revenue during the current fiscal year.

The petitions serve to bring the questions to a vote. Therefore, it is urged that all corporate members asked to sign such petitions do so, regardless of whether or not they share President Hastings' confidence "that today's members of our profession will be no less far-sighted than earlier generations of Society members, who not only provided us with an ever-growing and ever-more-useful Society, but also created the modest reserves upon which we now are drawing pending the operation of our democratic process of constitutional amendment to provide dues with which we can pay our own way," and that "our professional pride today will be no less than that of the men we succeed in the profession they created and enhanced, and that we, too, shall do our duty by future generations of civil engineers."

Bloom Bill Purposes Approved by Board

APPROVAL OF THE BROAD purposes of the so-called Bloom Bill which, as HR 4982, failed of passage in the 79th Congress, is voiced by the ASCE Board of Direction in a resolution which simultaneously opposes preparation of engineering designs, plans and specifications for, or engagement in supervision of construction of projects for foreign governments except when "the national interest demands otherwise."

The resolution, as adopted and ordered published by the Board, follows:

"WHEREAS, Other nations, recognizing the outstanding technical achievements of the United States, look to this country for guidance in the solution of their technical problems, and

"WHEREAS, It is in the interest of the Government of the United States that the best technical information and the best qualified talent in the country be made available to other nations requesting services needed to solve their domestic engineering problems;

"*Now, Therefore, Be It Resolved*, That the Board of Direction of the American Society of Civil Engineers approves the broad purposes of the Legislative Bill HR 4982-79th Congress, as they pertain to the field of applied science, specifically endorsing such government activities as the training of foreign engineering students in the United States, the international interchange of technical publications, hospitality for foreign engineers visiting in the United States, and the temporary assignment of properly qualified individual specialists, selected either from government service or private enterprise, as advisers to other governments together with such incidental assistance as may be necessary for the accomplishment of their individual assignments;

"*Be It Further Resolved*, That no federal agency should be permitted to prepare engineering designs, plans and specifications for, or engage in supervision of construction of, projects for foreign governments except when the Secretary of State shall determine that the national security and interest demands otherwise; and

"*Be It Further Resolved*, That the principal national technological bodies be urged, upon the request of the Secretary of State, to extend their services in furnishing advice as to the best method of meeting requests from foreign governments for technical services."

Petitions Circulated for Constitutional Amendments

Decision on Dues Increase or Curtailment of Activities Rests with Membership

WILLIAM N. CAREY
Executive Secretary, American Society of Civil Engineers

WITH PETITIONS IN CIRCULATION designed to bring to ballot two important issues—a recommended increase in Society dues and the proposal that Juniors be given the right to vote—this seems an excellent time to utilize these columns of CIVIL ENGINEERING as the medium for stimulating the scrutiny these matters deserve. That they merit earnest and early consideration is felt deeply by the members of the Board of Direction, who are making every opportunity to discuss them with Local Sections.

As President Hastings stated on the occasion of his inauguration, the decisions reached by the membership of ASCE on these matters affect "the very life and growth of the Society." Further, the nature of the issues is such that they must be decided soon, in order that the officers and directors may know the will of the membership; may have an expression of the course which it is desired the Society shall pursue as it nears the century mark of its existence.

Few members pay much attention to the overall finances of the Society. Few know that the budgeted expenditures for the fiscal year 1947 are just under $700,000. Most members think that their current dues provide the income funds against which annual expense is balanced. Few know that over one-third of our annual expense is not financed by our present members, but by our ultra-conservative forefathers in the Society. We are using the income from their wise investments in real estate and bonds in order to make our total income each year balance our total outgo. For this year, however, we are an estimated $56,000 short.

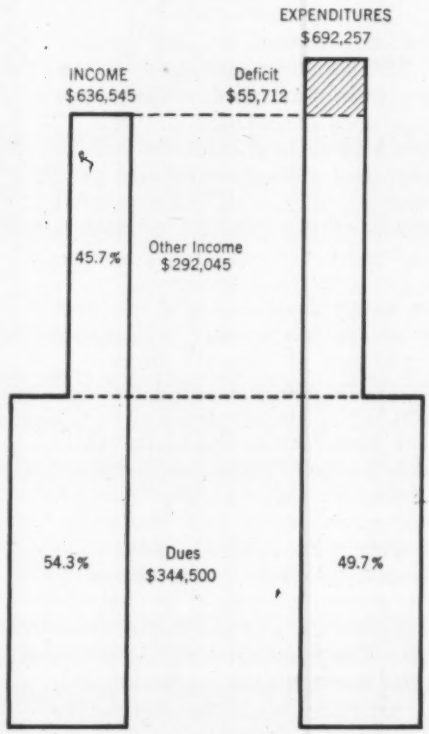
Discussions Are Urged

The foregoing are only a few of the facts which it is hoped will be brought out in discussions of the issues currently before the Society members at Local Section meetings. These meetings are intended to provide individual members with the detailed data they will require for the careful study which these questions should receive.

Briefly stated, the question each of us must ask himself is:

Shall the Society continue its present broad program of professional activities and expand that program, as it has in the recent past, or curtail those activities and effectuate a return to something more closely resembling the purely technical organization it was during its first 70-odd years?

SOCIETY BUDGET
Year Ending September 30, 1947



At first glance, only the recommendation for an increase in dues would seem to have any bearing on the foregoing question. How the proposal to enfranchise Juniors enters the picture is clarified by the fact that today there are some 6,500 young men in this segment of our membership, constituting just under one-third of our total membership. This segment is much more directly and continuously affected by and concerned with the non-technical phases of the ASCE's current program of activities than are the older corporate members. To these young men, the Society's interest in employment conditions, in classification and compensation schedules, and in its goal of establishing engineering as a true profession in the eyes of the public, are as important as its one-time sole activity in the field of purely technical improvement. Therefore, it behooves all corporate members, who are the only members of the Society now eligible to vote on the constitutional amendments required to decide these issues, to give due consideration to these younger engineers whom the Society is endeavoring to assist.

President Hastings stated his position on this combination of issues at the Annual Meeting as follows:

> **"I believe that a sense of fair play dictates that the time when two-thirds of our membership votes on the question of raising dues, including dues of a non-voting one-third of the membership, is the most propitious time for a corollary ballot on the question of giving the vote to that hitherto disenfranchised one-third."**

Dues of the Society last were increased in 1921. In the intervening quarter of a century, prices have risen and the cost of conducting Society business is vastly higher. The expenditures per member have increased from $25.40 in 1921 to an estimated $30 in 1947, as a result of those rising costs and an ever-expanding program, despite the fact that the total membership in 1946 was 21,216, or more than double that of 1921, when it was 10,275.

Juniors Are Attracted

The rate of increase in the ranks of the Juniors has far exceeded that of the older members. This attraction of the younger engineer to the Society can be ascribed to the diversification of our program and the broadening of our scope of activities to make ASCE more than a purely technical society. The figures on the increase in the number of Juniors are both interesting and significant.

In 1921, there were 452 Juniors, comprising 4.4 percent of the total membership. In 1946, there were 6,394 Juniors, 30.1 percent of the total membership. Juniors, of course, pay lower dues than do corporate members. This, then, accounts for the fact that in 1946 the average dues per member amounted to $15.40, while in 1921 the amount averaged $18.65 among less than half as many members.

Yet in 1946, because of revenue from other sources, the results of far-sighted investments by earlier generations of our profession, the $327,493 collected in dues constituted only 57.7 percent of the Society's total income of $567,553, while the $191,600 received in dues in 1921

amounted to 73.4 percent of that year's $260,700 of income.

As pointed out in an editorial elsewhere in this issue of CIVIL ENGINEERING, time is extremely important in considering these matters, and President Hastings has referred them to the corporate membership "for immediate and earnest consideration and prompt action." In doing so he expressed "the utmost confidence that the corporate members, who enjoy all the privileges of our Society, will manifest wisdom and fairness in rising to the responsibilities entailed by these decisions."

To facilitate a speedy and orderly consideration of the issues, Local Sections are being urged to hold early meetings for full and frank discussion of the Society's financial status as it is related to the current program of ASCE activities. From Society headquarters, there have gone forward to Local Sections forms of petitions requesting that the two issues be brought to ballot as constitutional amendments: (1) To provide an increase of $5 a year in the dues of Members, Associate Members and Affiliates and an increase of $2.50 a year in the dues of Juniors, and (2) to provide that Juniors shall have the right to vote on all ballots canvassed by the Society.

Procedure Is Outlined

These petition forms have been prepared in the interest of uniformity. The detailed constitutional language will be drafted and included at a later date, with ballots, following the discussion of such proposed amendments at the Annual Convention, as provided by Article X, Section 2 of the Constitution. These amendments may be so considered and submitted to ballot only upon receipt of petitions signed by 75 corporate members in each of the four zones of the Society. Juniors now can neither petition for the amendments, nor vote on them.

Our Constitution, at present, makes corporate members entirely responsible for the decision as to whether we shall continue to engage in efforts to promote the idea that civil engineering is a profession and should be regarded as such, or shall curtail activity directed toward professional recognition and advancement, dropping back to our early status of a fine technical and honor Society.

It should be emphasized that the wholehearted entrance of ASCE into the field of engineering welfare and professional advancement has been effected in addition to, and without sacrifice of, its former activities in the field of purely technical betterment. These additional activities on the professional front, combined with present-day high costs of everything, have placed ASCE beyond its support. We are in a situation much like that of an army which has advanced faster than its supplies. Such an army, short of gasoline, food, and ammunition, must halt until its supply forces are brought abreast of it. ASCE today has advanced beyond its financial support, and must postpone forward motion until additional financial supplies are made available. Unless financial support is promptly forthcoming, like the aforementioned army, we shall be forced to drop back. Without additional supplies, we cannot hope to hold what we have gained.

These issues are being placed before the entire membership of the Society for early consideration, and from time to time, as progress is made toward bringing them to ballot, articles will appear in CIVIL ENGINEERING covering pertinent discussions in the various Local Sections.

Brazilians Act to Form Local Section of ASCE

TIMING THEIR SESSION to coincide with the Annual Meeting of ASCE, at which their colleague, A. W. K. Billings, was awarded an Honorary Membership, 22 members of the Society residing in Brazil enjoyed dinner and a social evening in the club building of the União Cultural Brasil-Estados Unidos in São Paulo on January 15 and decided to apply for authority to establish a Local Section of the Society.

Francisco T. da Silva Telles was named chairman of the group, and he appointed W. L. Zeigler to act as secretary. Plans call for inclusion also of Society members residing in Rio de Janeiro.

Two cablegrams were dispatched by the group at the time of the meeting. One went to Mr. Billings in New York, congratulating him on the honor accorded him by the ASCE for his contributions to the profession, and made during his long residence in South America. The other was addressed to Col. William N. Carey, Executive Secretary of the Society, and expressed the South Americans' appreciation to the Society for the honor paid Mr. Billings.

MEMBERS RESIDING IN BRAZIL MEET for dinner and social evening in São Paulo. Seated, left to right, are: Frank Roberts, B. F. Barros Barreto, Francisco T. da Silva Telles, W. L. Zeigler, L. F. Harza, A. J. Ackerman. Standing are: J. C. Terry, Adolpho Santos, Jr., Raymundo José d'Araujo Costa, Odair Grillo, Elato Silva, Otavio Marcondes Ferraz, John G. Hollman, Clyde Wood, Paul G. Van Sickle, A. D. Harvey, Henrique Pegado, Raul L. Heslop, L. C. Heilbronner, Othelo de Souza Machado, F. T. Matthias, C. Z. Overstreet.

13 ASCE Technical Division Executive Committees Elect Chairmen for 1947

ALL 13 of the Society's Technical Divisions report election of chairmen for their executive committees for the year 1947 following the Society's recent Annual Meeting in New York. Following are the Divisions and the chairmen of their executive committees:

AIR TRANSPORT:	**Alfred J. Ryan,** consulting engineer, Denver, Colo., re-elected.
CITY PLANNING:	**Frank H. Malley,** planning director, City Planning Commission, Buffalo, N.Y., succeeding Col. William J. Shea.
CONSTRUCTION:	**Kirby Smith,** Rear Admiral, CEC, USNR, sales manager, Raymond Concrete Pile Co., New York, N.Y., reelected.
ENGINEERING ECONOMICS:	**L. K. Sillcox,** first vice-president, New York Air Brake Co., Watertown, N.Y., succeeding Jonathan E. Teal.
HIGHWAY:	**Charles M. Upham,** engineering director, American Road Builders Association, Washington, D.C., succeeding Day I. Okes.
HYDRAULICS:	**William G. Hoyt,** executive officer, Water Resources Committee, Land Utilization Office, Department of Interior, Washington, D.C., reelected.
IRRIGATION:	**George L. Henderson,** chief engineer, Kern County Land Co., Bakersfield, Calif., succeeding H. D. Comstock.
POWER:	**Joel D. Justin,** consulting engineer, Philadelphia, Pa., succeeding Arthur T. Larned.
SANITARY ENGINEERING:	**Prof. Gordon M. Fair,** Harvard Graduate School of Engineering, Cambridge, Mass., succeeding Prof. George J. Schroepfer.
SOIL MECHANICS AND FOUNDATIONS:	**Frank A. Marston,** consulting engineer, Boston, Mass., reelected.
STRUCTURAL:	**E. L. Durkee,** engineer of erecting, Bethlehem Steel Co., Bethlehem, Pa., succeeding Alfred Hedefine.
SURVEYING AND MAPPING:	**Prof. George B. Earnest,** Case School of Applied Science, Cleveland, Ohio, succeeding Prof. Philip Kissam.
WATERWAYS:	**W. W. DeBerard,** city engineer, Bureau of Engineering, Department of Public Works, Chicago, Ill., succeeding Col. C. L. Hall.

ASCE Men Aid N.Y. in Pile Foundations Study

TWO ASCE MEMBERS are representing the Society in assisting the City of New York in a study looking toward revision of its piling code, which is followed rather closely throughout the country. The ASCE representatives are Rear Admiral R. E. Bakenhus, CEC, USN retired, and a past director of the Society, and Prof. D. M. Burmister of the Columbia University civil engineering department.

These representatives were appointed by President E. M. Hastings at the request of Councilman Hugh Quinn, after consultation among Councilman Quinn, who heads the committee, W. N. Carey, Executive Secretary, ASCE, and Dr. D. B. Steinman, president of the Society's Metropolitan Section. The committee is composed of piling and foundation experts and is known as the Special Committee on Revision of the New York City Code on Pile Foundations.

Admiral Bakenhus, who was chairman of the ASCE committee which prepared the recently published Society manual on pile foundations, was named by the committee as its acting chairman to preside at its sessions whenever Councilman Quinn is absent. Representatives of the New York State Society of Professional Engineers, the Structural Engineering Society of New York, the National Lumber Manufacturers Association, the Portland Cement Association, the American Iron and Steel Institute, and the General Contractors Association, also are members of the committee.

Illinois Section Joins in Power Conference

THE ILLINOIS SECTION of the American Society of Civil Engineers was one of the seven societies participating in the three-day Midwest Power Conference held March 31, April 1 and 2, at the Palmer House hotel, Chicago. The 1947 conference—the ninth annual meeting—was attended by more than 2,500 engineers from the United States and foreign countries. Power, its production, transmission and consumption, with the current problems and the recent developments of each phase, were discussed.

The conference was sponsored by the Illinois Institute of Technology with the cooperation of Iowa State College, Michigan State College, Northwestern University, Purdue University, State University of Iowa, University of Illinois, University of Michigan, University of Minnesota, and University of Wisconsin. Other societies represented in the conference were: The Chicago section of the American Institute of Engineers, the Chicago section of the American Institute of Electrical Engineers, the Chicago section of the American Society of Mechanical Engineers, the Illinois chapter of the American Society of Heating and Ventilating Engineers, the Western Society of Engineers, and the Engineers Society of Milwaukee.

D.C. Section Organizes Technical Activities

A NEW IDEA has been inaugurated by the District of Columbia Section of ASCE to obtain greater participation in the Society's technical activities by making it easier for its members to take part in the work of the parent Technical Divisions. President William G. Hoyt, of the D.C. Section, announced that a committee has been appointed to coordinate technical activities and act as liaison between Local Section technical committees and parent Society Technical Divisions. The local committee will work with the parent Society's Technical Divisions without going through the Local Section's officers, thereby providing a direct channel of service.

The D.C. Section is probably in a unique position in that it is one of the few Local Sections having members interested in the activities of all the Society's Divisions. Each member selected for the committee is recognized and especially qualified in the particular field which he represents. The representatives and committee affiliations are as follows:

MEMBER	TECHNICAL DIVISION
E. Robert de Luccia, chairman	Power
R. C. Price, secretary	
Frank H. Cosgrove	Air Transport
Jacob L. Crane	City Planning
T. R. Edmonston	Construction
Charles D. Curran	Engineering Economics
W. N. Carey, Jr.	Highway
Joseph B. Wells	Hydraulics
W. E. Corfitzen	Irrigation
Harry B. Shaw	Sanitary Engineering
T. A. Middlebrooks	Soil Mechanics & Foundations
Bernard F. Locraft	Structural
Henry W. Hemple	Surveying & Mapping
Eugene Weber	Waterways

Two Labor Bills Seek to Aid Professional Employees as EJC Prepares Presentation

MAINLY AS A RESULT OF ASCE efforts, the words "professional employee" loom large for the first time in proposed amendments to the National Labor Relations Act (Wagner Act). Identical definitions of a "professional employee" and a "professional employee" in training are contained in S-360 and HR-1754.

The first-mentioned bill was introduced by Senator Joseph Ball of Minnesota on January 27, and HR-1754 on February 6 by Congressman Carl Hinshaw of California, Assoc. M. ASCE.

Each of these bills is for amendments to the present Wagner Act. Senator Ball's bill is of broad scope, but includes specifically the legislation desired by the engineering profession as represented by ASCE, Engineers Joint Council, and other national engineering organizations. Congressman Hinshaw's bill concentrates solely on bettering the status of professional employees under labor laws.

Enactment into law of S-360 or HR-1754, or both, would go far toward accomplishing the Board-of-Direction-approved objectives of ASCE regarding remedial labor legislation. These objectives were published in CIVIL ENGINEERING for November 1946, page 511, as "three fundamentals" and they were adopted by EJC in December.

The Wagner Act, amended in accordance with those fundamentals, would guarantee to professional employees the right to bargain collectively and in units composed solely of professional men, but only when and if they chose to bargain collectively. These amendments outlaw the closed shop and specifically provide that membership in any organization, labor or otherwise, cannot be made a condition of employment.

Early additional action is in prospect in the engineers' battle along the remedial labor legislation front and aimed at freeing professional men from involuntary membership in trade labor unions. This action will come in the form of appearance of an EJC panel before Senate and House labor committees. The panel, selected through Engineers Joint Council, will present a united front on behalf of some 100,000 members of the five constituent societies of EJC, plus other organizations. (See CIVIL ENGINEERING, January 1947, page 46.)

Declaring in favor of the labor policy adopted by the ASCE Board of Direction, Engineers Joint Council requested the presidents of its five constituent societies, of the National Society of Professional Engineers, and of the American Society for Engineering Education, each to name one of their specially qualified members for duty on a panel to appear before Congressional committees and promote the EJC-adopted policy for remedial labor legislation. The panel will function in close cooperation with E. Lawrence Chandler, ASCE's Eastern Representative, at Washington, D.C., who has performed extensive preliminary work in this connection.

Those named to the panel so far are: Gail A. Hathaway, Washington, D.C., vice-president of ASCE and chairman of its Committee on Employment Conditions, to represent ASCE; William F. Ryan, Boston, Mass., representing ASME; Clark W. Ransom, Pittsfield, Mass., representing AIEE; Dr. Harry S. Rogers, M. ASCE, president of Brooklyn Polytechnic Institute, representing American Society for Engineering Education; and Ritchie Lawrie, Jr., Harrisburg, Pa., president of the National Society of Professional Engineers, representing that organization.

All members of ASCE will find S-360 and HR-1754 of more than passing interest. Persons desiring copies can obtain them by written request to their senator or congressman.

Engineering Foundation Asks Gifts for Research

OPPORTUNITIES FOR PRODUCTIVE engineering research have increased in the postwar period and as a result the Engineering Foundation would welcome bequests and gifts to supplement its current principal fund for research of about $1,000,000.

The Foundation, created by the four Founder Societies in 1914, has been engaged in important research activities for more than 30 years. Its present chairman, Dr. A. B. Kinzel, is an internationally known metallurgist—vice-president of the Union Carbide and Carbon Research Laboratories, Inc., and of the Electro Metallurgical Co.

To quote from a recent statement of Dr. Kinzel, "The Foundation's sponsorship and financial support of a research project most commonly stimulates or enables the obtaining of additional and frequently much larger contributions of money, material and services from institutions, industry and individuals. While its expenditures in research have totaled $635,600, these have acted as a catalytic agent or stimulus to the expenditures on research sponsored by the Foundation of about $5,000,000."

The Foundation has supported engineering research and investigations in such fields as: arch dams for power development, etc.; soil mechanics and foundations; arch and column design; hydraulic research; thermal properties of steam; welding; stability of steels as affected by temperature; plastic flow of metals; alloys of iron; metal cutting; cotton-seed processing; di-electrics and power-cable insulation; and many other fields.

The Foundation is a department of the United Engineering Trustees, Inc., a non-profit organization exempt from federal income tax. Contributions made to the United Engineering Trustees, Inc., for the Engineering Foundation Fund, are deductible for federal income tax purposes to the extent provided by the Act. The Foundation is administered by a board of 16 members, including men outstanding in the engineering profession, research, business and education. Inquiries about gifts and bequests may be directed to John H. R. Arms, Secretary of the Engineering Foundation, Engineering Societies Building, 29 West 39th Street, New York 18, N.Y.

Section Publication Lauds Annual Meeting

"THE BEST PLANNED, best organized and best handled" Annual Meeting is what the *Tennessee Valley Engineer* for February has to say of the Society's 1947 January session, in an article by Nicholls Bowden and Ross Riegel.

"Not only were the general meetings well attended and interesting, but also the sessions of the Technical Divisions, where often there were several hundred engineers present. The papers and discussions were unusually interesting and 'snappily handled,' in contrast with other meetings of the Society in recent times. The previous criticism in CIVIL ENGINEERING of the long-drawn-out meetings of the Technical Divisions, the poor presentations of papers, and the need for general improvement must have had its effect."

The article singles out the Hydraulics Division sessions for particular praise, pointing out that the "chairman saw to it that the speakers conformed with time limitations and held discussions to the time allotted. His good-natured threats to 'take over' and curb any over-zealous 'orator' brought good humor and bore fruit. This is really noteworthy as a good start toward making the often too dull technical sessions more entertaining. If the policy is continued, the sessions are sure to show even larger attendance and greater interest in the future."

Advertising Manager for "Civil Engineering," Assistant Technical Publications Editor Named

APPOINTMENT OF A new advertising manager for CIVIL ENGINEERING and of an assistant editor for ASCE Technical Publications is announced by Col. William N. Carey, Executive Secretary of the Society.

James T. Norton has been appointed advertising manager of CIVIL ENGINEERING, succeeding W. L. Glenzing, who has resigned after sixteen years with the Society to become advertising manager of *Public Works News*. Mr. Norton comes to the Society with an extensive background in both advertising and sales, having been account manager with the Greebe Advertising Agency, where he planned and carried out numerous campaigns in trade paper, newspaper, and direct mail advertising.

Prior to his agency work, he directed the sales and advertising activities of the Bludworth-Marine Division of National-Simplex-Bludworth, Inc., one of the leading manufacturers in the relatively new field of electronic navigation equipment. Early in the war, Mr. Norton also served for a period with the U.S. Maritime Commission, as assistant director of large-vessel procurement, arranging the acquisition of all available ship tonnage for the war effort. Before coming to New York to enter the advertising and sales fields, Mr. Norton was in the quarrying and construction business in upper New York State.

JAMES T. NORTON

HERBERT P. ORLAND

Herbert P. Orland, Jun. ASCE, has been appointed to the new post of assistant editor, ASCE Technical Publications. Mr. Orland comes to the staff after several years as assistant editor of *Engineering News-Record*. A graduate of Cornell University, class of 1935, he has also been town engineer of Northfield, Vt. In the war, Mr. Orland served as captain in the U.S. Army Corps of Engineers.

Procedure for the Consideration of Matters Brought Before the Board

AT THE JULY 1946 MEETING of the Board of Direction at Spokane, Wash., the procedure as quoted below was adopted by the Board of Direction. This procedure provides rules and recommendations concerning the submission of matters to the Board of Direction for action, and is published here for the information of the ASCE membership.

Procedure

1. The intent of the procedure herein set forth is to assure more time for the Board of Direction, at its regular meetings, to give adequate consideration to questions which involve matters of policy or to items of expense not provided for in the approved budget current at the time.

2. Reports of Committees of the Society, as listed on page 3 of the 1946 Official Personnel Directory (Vol. 72, No. 2, Part 2 of the 1946 PROCEEDINGS), with exceptions as noted below, in order to be acted upon by the Board at a quarterly meeting, will be delivered to the office of the Executive Secretary at least 45 days prior to the first day of the Board meeting at which Board decision on any such report is desired.

EXCEPTIONS, Committee:
Honorary Membership, Membership Qualifications, Meetings.

All prize and scholarship committees.

3. Reports of Committees of Technical Divisions, Special Committees, Joint Committees, Panels, Boards or other committees, when such reports require specific Board action, also will be delivered to the office of the Executive Secretary as provided in Par. 2.

4. (A) Reports submitted as provided in Par. 2 will be entered in the preliminary agenda for the Board meeting at which action is to be taken on such reports.

(B) In order that Board decision may be taken on any report (except emergency matters and reports of committees excepted in Par. 2), the respective report must be contained on the preliminary agenda for the Board meeting at which decision is desired. Reports not on the agenda for a particular Board meeting and not falling in the excepted class may be received by the Board but other action thereon will not be taken at that meeting.

5. Except in cases of emergency as provided in Par. 6, the Board will not take action on any matter involving material modification of policy or requiring expenditure in excess of $500 unless the matter has been carried in the advance agenda for the Board meeting at which decision is desired.

6. Nothing in these rules of procedure shall be considered as a bar to any committee or other officially appointed person or group, or any member of the Board from presenting any matter formally to the Board for decision without compliance with the procedures above set forth, provided: (*a*) that the Society unit submitting such report states that the matter is of such emergency character as to have made compliance with these rules of procedure impossible or impracticable, and provided further (*b*) that in such cases a brief statement justifying the emergency character of such report shall be submitted to the Board, and provided further (*c*) that such report will not receive immediate action by the Board unless and until, by vote of the Board, decision is made that the matter submitted is of such urgency as to require immediate action. Actions of the Executive Committee, but not its recommendations, as may be submitted to the Board, are not subject to the 45-day limitation provided in Par. 2.

7. In general, reports appearing in the advance agenda of a Board meeting will not be read in their entirety to the Board at the meeting.

Section Head Urges Action on Amendments

ITS PRESIDENT, L. A. Schmidt, Jr., is calling upon the Tennessee Valley Section of ASCE to be "the first Section to present to the Board of Direction our petition to increase the dues and to enfranchise the Junior members." He does so in the "President's Column" of the February issue of *The Tennessee Valley Engineer*, the Section's monthly bulletin.

"Our Section has always been a leader in all matters of the Society," President Schmidt writes, "and we have again the unique opportunity to be the first Section to present to the Board of Direction our petition to increase the dues and to enfranchise the Junior members. Accordingly, I am asking that our Sub-Sections take immediate action on these two issues so that we may present our canvassed opinions as early as possible."

Certificates of Life Membership Awarded to 227

ON JANUARY 1, 1947, a number of ASCE Members became Life Members, an honor which includes exemption from further payment of dues. This action is in accordance with the constitutional provision, applying to those who are 70 years old and have paid dues as Corporate Members or Affiliates for 25 years, and to Corporate Members or Affiliates who have paid dues for 35 years, regardless of age.

As usual, the letters of notification brought a number of interesting replies. Many express surprise: "It is difficult for me to realize that I have been a member for 35 years, but the records must be correct." "I was greatly surprised and pleased, as I had no idea that I was eligible at this time." "It was a surprise and distinct shock to receive your kind letter transmitting a Life Membership diploma. It was the cause of immediately starting to count back—how old was I 35 years ago? Can I be this age now?"

The last member quoted goes on to say, "During the past 20 years my work has been in an isolated location, far from Headquarters and 100 miles from the nearest Local Section, so it has not been practicable to participate in many meetings, but the Society publications have always been thoroughly read and appreciated."

From an executive of a large construction company comes an expression of appreciation of benefits obtained from the Society: "The Society has grown in numbers and influence during my membership, and has contributed immeasurably to the advancement of its members and the profession. I have received from it much more than I have given and am duly grateful." In the same vein, another member says, "I have gained more from the Society's work than I have given."

The head of a large public works department on the West Coast writes: "No one who has been a member of the Society long enough to obtain a Life Membership can fail to appreciate the great value of the Society to the civil engineering profession as a whole and to the individuals as members."

Other compliments include: "The Society has long been one of my most treasured affiliations" (from the head of a construction company). "I have always worn the badge of the Society with pride, and as a mark of distinction" (from a retired transportation engineer). "My membership in the Society has been one of the things I have cherished most through the years" (from a retired engineer in government service). "It is a great honor and deeply appreciated" (from a large West Coast contractor). "I have cherished my membership in the Society and shall feel highly honored to become a Life Member" (a New England consultant).

A Society officer, in acknowledging receipt of his certificate, calls it "a grand document." A Texas consultant writes: "I take this opportunity to state to the officers of the Society my appreciation of the ethical leadership, the well-sifted technical information, and the splendid encouragement that we younger members received during the lean years of our professional life." The chairman of the board of a large bridge company states, "The high ideals, dignified conduct, and conservative policies of the Society have always made me regard membership therein as a privilege and an honor, as did my father before me."

Members Exempt from Dues January 1, 1947

Alfred Curtis Ackenheil
William Henry Adams
David Arthur Allee
Carl Bowers Andrews
James Henry Millar Andrews
Robert Edmund Andrews
Thomas Allen Appleton
Charles Dwight Avery
William Joshua Barney
Frederick Bayard Barshell
Harold Hendryx Barter
Charles Terrell Bartlett
Edward Bartow
Ora Grover Baxter
Jay Foster Beaman
Ralph Agustus Beebee
Thomas Rupe Beeman
Lucius Tullius Berthe
Arthur Frederick Blaser
Carl August Bock
Clinton Lathrop Bogert
Thomas Lacey Bonstow
Perry Elmer Borchers
Edward Rose Bowen
George Ray Boyd
James Murray Boyle
Royall Douglas Bradbury
Joseph Shirley Bright
Elmer Hovey Brown
George Robert Ure Buchanan
Gordon Byron Canaga
Carl Alexius Carlson
Ossian Elmer Carr
William Joseph Carrel
Lester Levi Carter
Albert Aeneas Casani
Daniel Rogers Cate
John Taylor Chambers
Elbert Milam Chandler
Robert Simpson Charles
Horace Holmes Chase
Willard Townshend Chevalier
Chester de Baun Christie
Arthur Lee Collins
Charles Irving Colyer
Edwin Keen Cortright
Juan Antonio Cosculluela y Barreras
Arthur Emmett Cowell
Fredrik Norman Cronholm
Francis Stirling Crowell
John Earl Cunningham
James Francis Curley
Thomas Hendricks David
Arthur James Decker
Isidore Delson
Barry Dibble
Harry Custer Diesem
George Gale Dixon
Richard Erwin Dougherty
Edwin Leroy Driggs
Robert Moore Dunham
Austin Willmott Earl
Olaf John S. Ellingson
Eber J. Ellsworth
Frederic Elwin Everett
Almon Lawrence Fales
Donald Barry Fegles
True Herbert Files
Ingwald Edward Flaa
Francis Seeley Foote
Robert Myron Fox
Floyd Willis Frederick
William Bradly Freeman
Carson Geyer French
Roger DeLand French
Chester Arthur Garfield
Winfred Dean Gerber
Henry Gerharz
Ben Clifford Gerwick
William Herbert Gibson
Albert Givan
Clinton Raymond Goodrich
Samuel Rowland Graham
Leon Morley Gray
David Gutman
Herbert Miller Hale
Harry Rutledge Hall
Julius Reed Hall
Wilbur Sherfey Hanna
Solomon Jacob Harwi
Charles Ellsworth Haywood
Laurence Ilsley Hewes
Clifton Ewing Hickok
Harry Cyrus Hill
Meier George Hilpert
George Stevens Hinckley
Albert Harrison Hinkle
John Philip Hogan
Joseph Vincent Hogan
Carl August Hoglund
Howard Whittier Holmes
Nicholas Hanson Holmes
Frederick Ruthrauff Hoover
Raleigh Hortenstine
Clement John Howard
Prévost Hubbard
William Thomas Huber
Charles Morris Hunter
Harry Luther Hurd
Joseph Husband
Joseph Warren Jones
Lewis Allen Jones
Stanley Albert Kerr
William Henry Kershaw
George Kingsley
Lebrecht Julius Klug
Walter Joseph Knight
Alfred Julius Krafft
Robert Lacy
Thomas Leach
Jason Casimir Le Duc
Robert Walker Lemen
Henry Leser
Aaron Gretzner Levy
John Edward August Linders
Alfred Raymond Lindsey
Charles Hunter Locher, Sr.
Henry Delano Loring
Andrew Cavitt Love
William Sherman Lozier
Alfred Majendie Lund
Stephen Wood McClave, Jr.
Andrew Horace McDougall
Peter Alexander McLeod
John Crane McVea
Joseph Patrick Martin
Irving Ellsworth Matthews
George Mattis
Geoffrey Wainman Mayo
Herbert Drummond Mendenhall
Robert Hall Merrill
Richard Messer
Winfred Leon Milner
Roy Saxton Moore
Robert Miller Morton
William Benjamin Moss
Oren McKenney Moulton
Hans Mumm, Jr.
Ray Messinger Murray
Lawrence Kenneth Needham
George Cheney Newton
George Henry Nolan
Edward Newton Noyes
Tom William Osgood
Daniel Willets Overocker
William Waters Pagon
Lorenzo Perez Castro
John Prince Hazen Perry
Tracy Irwin Phelps
Archie Burton Pierce
Charles Henry Pierce
Oscar Albert Piper
George Gordon Pollock
Henry George Porter
Charles Underhill Powell
Porter Johnstone Preston
William Edmund Price
John Clinton Prior
Harold Beggs Pullar
George Austin Quinlan
Robert Stuart Royer
Ralph Rollins Rumery
James Tillman Ryan
Lester Morse Sanford
Henry Alexis d'Origny Saurbrey
Ned Hensel Sayford
Francis Rauch Schmid
Frank Charles Schroeder
Ray Seely
Elwyn Eggleston Seelye
Franklin Dickinson Shaw
Clarence Osborne Sherrill
Charles Randolph Simpson
James Hampden Small
Clarke Stull Smith
Henry Atterbury Smith
Herman Henry Smith
Vernon Hayes Smith
Walter Lynes Smith*
Edward Beniah Snell
Walter James Spalding
Charles Willett Spooner
Charles Wolcott Stark
Frank William Stephens
Frank Ernest Sterns
Spencer Wilson Stewart
Charles Edward Stilson
Walter Pearce Stine
James Hammond Stone
William Edmund Stoney
Robert August Strecker
John Simeon Swan
Gustavus William Thompson
Oliver Julian Todd
Frank Clifton Tolles
Carl Perkins Tomlinson
Adolphus Gustavus Trost
Alfred Lockwood Trowbridge
Karl Otto Truell
William Frank Uhl
Sanders Van Auken
William Herbert Vance
Harry Chittenden Vensano
Karl Eugene Vogel
Bertrand Hinman Wait
Jacob Latch Warner
Walter Owen Washington
Frank Merrill Weakley
Benjamin Thomas Weston
Walter Austin Wheeler
Clement Clarence Williams*
Melvin Delano Williams
William Horace Williams
Albert Jones Willis
William Wilson
Thomas Judson Wright, Jr.
Walter Charles Youngs
Oscar Ambrose Zimmerman

* *Deceased*

Contractors Hear Talk of President Hastings

ASSUMPTION OF "our rightful position in the thinking of the nation and of the world, in order that the foundations now laid will be foundations that are secure and upon which the world of the future can stand," was advocated for constructors and engineers in a recent address prepared by E. M. Hastings, ASCE president.

The address was read for Mr. Hastings at the 28th annual convention of the Associated General Contractors of America in Chicago, when his plane was grounded and he was unable to attend the convention. President Hastings urged the members of the engineering profession and the construction industry "not to overlook the opportunities of 1947."

To those members of the Associated General Contractors of America who also are ASCE members, Mr. Hastings reiterated his position in favor of the proposed increase in ASCE dues and the proposal to give Juniors the right to vote, as voiced by him in his inaugural address. (See CIVIL ENGINEERING for February 1947, page 91.)

Dinner Features Thirteenth Milo S. Ketchum Award

THE MILO S. KETCHUM AWARD, consisting of the initiation fee for Junior membership in ASCE and a Society pin, has been won by Carl Smith, a graduate of the University of Colorado and member of the ASCE Student Chapter there. The occasion of the presentation was the annual Ketchum Award dinner held on January 30 in Boulder, Colo. A special feature of the dinner was the presence of Mrs. Milo S. Ketchum, Senior. For the first time the meeting was open to wives of students and faculty. About 120 attended.

Principal address was made by Dean Oliver C. Lester of the Graduate School, who recalled former days on the Boulder campus when Mr. Ketchum was dean of the Engineering School. Mrs. Ketchum responded, expressing appreciation of this living memorial to the memory of Dean Ketchum. Professor Warren Raeder, M. ASCE, head of the Department of Civil and Architectural Engineering, announced the winner of the award for 1946 to be Carl Smith, now employed at the U.S. Bureau of Reclamation in Denver.

Established in 1936, the Milo S. Ketchum Award is made annually to a graduating student at the University of Colorado for general excellence, including activity in the ASCE Student Chapter.

Mechanical Engineer Wins 1946 Alfred Noble Prize

MARTIN GOLAND—junior member of the A.S.M.E. and chairman of the engineering mechanics section of the Midwest Research Institute, Kansas City, Mo.—has been awarded the Alfred Noble Prize for his paper, "The Flutter of a Uniform Cantilever Wing." The same paper, which appeared originally in the *Journal of Applied Mechanics*, also received the 1946 Junior Award of the A.S.M.E. The prize will be presented at an early meeting of that society.

Mr. Goland was educated at Cornell University, from which he received an M.E. degee in 1940.

Established in 1929, the Alfred Noble Prize was made possible by a fund contributed by friends of Mr. Noble, one-time President of the ASCE. The prize is awarded annually to a young member of one of the four Founder Societies or the Western Society of Engineers for a published technical paper of unusual merit.

Library Increases Rates for Translations

AMONG THE SERVICES rendered by the Engineering Societies Library, 29 West 39th Street, New York 18, N.Y., are searches and translations. For some time these have been done at a loss as the prewar rates do not cover current costs.

At its meeting on January 9 the Library Board, which functions as a part of the United Engineering Trustees, Inc., increased the rates as shown in the following tabulation.

As in the past, a discount of 20 percent on searches and translations is granted to members of the Founder Societies who order work for their personal use and pay for it by personal check.

SERVICES	FORMER RATE	PRESENT RATE
Searches	$2.50	$3.00 per hr
Translations from German, French, Italian, Spanish to English	1.00	1.50 per hundred words
Translations from Russian, Polish, Dutch, Portuguese, Danish, Swedish, etc., to English	1.20	2.00 per hundred words
Translations from Japanese, Chinese, etc., to English	3.00	3.00 per hundred words (unchanged)

Fine Meeting Record Made by Cornell '09

IT IS BELIEVED that the 1909 Class of Cornell University made some sort of a record at the recent Annual Meeting of the Society in New York. At least seven members of this class attended the Meeting, including one who presented a paper. These included:

George F. Wieghardt, M. ASCE, Chief Engineer, Hackensack Water Co., Englewood, N.J.

Frederick J. Biele, M. ASCE, consulting engineer, Huntington, N.J.

Arthur W. Harrington, M. ASCE, U.S. Geological Survey, Albany, N.Y.

Robert M. Fox, M. ASCE, City Engineer, Bethlehem, Pa.

J. D. Tuller, Tuller Construction Co., Red Bank, N.J.

Newton C. Farr, real estate consultant, Chicago, Ill. (a speaker before City Planning Division)

Gustav J. Requardt, M. ASCE, consulting engineer, Baltimore, Md.

Is it possible that any other engineering class graduating more than 30 or even 20 years ago had a greater number of its members at the Annual Meeting?

Library Requests Extra Publications for Exchange

AN APPEAL TO ASCE Members for old copies of CIVIL ENGINEERING and PROCEEDINGS has been sounded by the Engineering Societies Library. Need for various publications at this time is occasioned by the reopening of exchange relations with publishers and libraries abroad. Publications for the war years and postwar period are particularly scarce owing to the paper shortage. Prewar publications are also needed to replace worn-out volumes. Publications are to be mailed to Engineering Societies Library, 29 West 39th Street, New York 18, N.Y.

Society Appointments

THE EXECUTIVE COMMITTEE of the City Planning Division announces the appointment of John M. Picton, M. ASCE, for a five-year term, succeeding Col. William J. Shea, M. ASCE. At the time the other Divisions were announcing the appointment of new members to their executive committees, the City Planning Division was not ready to make an appointment.

53 Percent Reply in Survey of Profession

TABULATION OF 47,272 usable questionnaires returned in the 1946 survey of the engineering profession conducted by Engineers Joint Council is under way in Washington, D.C., according to word received from Andrew Fraser, consultant acting for EJC in liaison with the U.S. Department of Labor's Bureau of Labor Statistics. The returns are from the 86,900 members of the six leading engineering societies who received questionnaires and represent slightly more than 53 percent of the total number of questionnaires sent out.

Preparatory to compilation of a report based on the replies, which will center to a great degree on the economic status of the engineer, Mr. Fraser has made a preliminary analysis which indicates that 12 percent of the professional engineers in the country were in the Armed Forces some time during the period 1939–1946, and that in general the Services used the special skills of professional engineers to a high degree. The survey is sponsored by the Engineers Joint Council's Engineer Survey Committee, a subcommittee of the EJC Committee on the Economic Status of the Engineer. Col. William N. Carey, Executive Secretary of ASCE, is chairman. Cooperation of the Bureau of Labor Statistics was enlisted in the interest of economy, the Bureau being equipped to take care of the type of precoded questionnaire which was used.

Joint New York Sections Committee Convenes

A PROPOSED AMENDMENT to the National Labor Relations Act, defining professional employees and guaranteeing them complete freedom to join or to refrain from joining any labor organization was discussed at the first meeting of the recently organized Joint Committee of ASCE Local Sections—held in New York on January 14. The Committee recommended that the Society give its support to the enactment of such an amendment, and approved five proposed amendments to the New York State Engineers' Law.

These amendments include revalidating the 15-year clause permitting the Board of Engineers to waive examinations; revalidating the interstate endorsement clause granting registration to out-of-state engineers; and permitting temporary practice by engineers registered in other states. The Committee also discussed the present unsatisfactory method of basing engineering fees on 1940 price estimates, now used by the New York State Postwar Planning Commission and decided to bring the matter to the attention of the Commission, with the request that it adjust its price basis to agree better with present-day costs.

As announced in the January issue of CIVIL ENGINEERING, the function of the Joint Committee will be to present to the legislature at Albany the recommendations of the ASCE membership in the state relative to proposed or desired legislation. Earl F. O'Brien, of the Syracuse Section, is chairman of the Committee.

Indiana Legislators Are Entertained by Engineers

MEMBERS OF the Indiana State Legislature, now in session, and all heads of the state departments employing engineers were invited to attend a joint dinner meeting of the Indiana Section of ASCE and the Indiana Society of Professional Engineers held on January 28. The theme of the meeting was the service of engineers to the State of Indiana.

Principal speakers on this occasion were Prof. R. B. Wiley, of Purdue University, Vice-President, ASCE, who spoke from the standpoint of the engineering educator and his interest in the professional development and improvement of engineering graduates; and M. W. Cameron, ISPE, who told of the work of engineers in the various departments of the state government.

This hospitality on the part of the engineers is a novel one and served to impress on the members of the legislature who attended the importance of engineering in the functioning of the state government. Seventy-five members of the legislature were present out of a total of 150.

ASCE Sub-Section Formed at Oak Ridge

ON PETITION OF 26 ASCE members at Oak Ridge, Tenn., the Board of Directors of the Tennessee Valley Section has approved the formation of a new Sub-Section at Oak Ridge. The signators stated that an active organization, closer than the nearest existing Sub-Section (Knoxville), would provide local members with an incentive for more active participation in Society affairs and a stimulus to gain more from their ASCE membership than is obtainable from only occasional participation in distant meetings.

The Tennessee Valley Section, which was established in 1932, already has Sub-Sections at Asheville, N.C.; Chattanooga and Knoxville, Tenn.; and Muscle Shoals, Ala. A committee, consisting of DuVal Stoaks, Ned Williams, and Murray A. Ruth, has been instrumental in organizing the Oak Ridge unit.

NEWS OF LOCAL SECTIONS

Coming Events

Dayton—Meet at National Cash Register Co., Dayton, March 17, at 11:30 a.m., for tour of plant.

District of Columbia—Meeting in the Cosmos Club Auditorium, Washington, March 18.

Indiana—Joint dinner meeting with the Purdue University Student Chapter at the Purdue Memorial Union, West Lafayette, March 21, at 6:30 p.m.

Los Angeles—Dinner meeting at the Los Angeles Athletic Club, Los Angeles, March 12, at 6:30 p.m. Program will start at 8 p.m.

Maryland—Meeting at the Engineers' Club, Baltimore, March 19, at 8 p.m. Meeting preceded by cocktails at 6 p.m., and dinner at 7 p.m.

Metropolitan—Meeting in the Engineering Societies Building, New York, March 19, at 8 p.m.

Philadelphia—Meeting at the Engineers' Club, Philadelphia, March 11. Dinner at 6 p.m.; meeting at 7:30 p.m.

Sacramento—Regular luncheon meetings at the Elks Club, Sacramento, every Tuesday at 12 noon.

St. Louis—Luncheon meeting at the York Hotel, St. Louis, March 24, at 12:15 p.m.

Tennessee Valley—Spring meeting at Gatlinburg, Tenn., on April 11 and 12. Registration at the New Gatlinburg Inn, April 11, at 10 a.m.; business meeting and technical session that afternoon; banquet at the Mountain View Hotel in the evening. On Saturday morning there will be an automobile trip to a little-known part of the Great Smoky Mountain National Park, followed by separate noon luncheons for the men and visiting ladies.

Dinner meeting of the Knoxville Sub-Section at the S & W. Cafeteria, Knoxville, March 12.

Texas—Luncheon meeting of the Dallas Branch at the Adolphus Hotel, Dallas, April 7, at 12:15 p.m.; luncheon meeting of the Fort Worth Branch at the Blackstone Hotel, Fort Worth, March 10, at 12:15 p.m.

Tri-City—Joint dinner meeting with the Engineers Club of Iowa City at the Engineers Club, Iowa City, March 10, at 6:30 p.m.

Scheduled ASCE Meetings

Spring Meeting, Phoenix Ariz., April 23–26
(Board of Direction meets April 20–22)
Summer Convention, Duluth, Minn., July 16–19
(Board of Direction meets July 14–15)
Fall Meeting, October
(Place and dates to be announced later)

Recent Activities

CENTRAL OHIO

A PARK SYSTEM for Columbus and Franklin County, similar to those enjoyed by several Ohio communities, is under way in Columbus and has been legally authorized, Edward S. Thomas, curator of the State Archaeological and Historical Society, told the members at the January dinner meeting. The speaker, who is chairman of the Metropolitan Park Commission, described the development of park systems in other cities and cited the advantages of such parks. During the evening, the Section approved a resolution to the city officials, requesting that the city and county jointly support a planning commission for the purpose of preparing a master plan.

CINCINNATI

FOR THE FIRST time since the invention of the airplane the design of runways is abreast with, and in some respects ahead of, airplane design, R. R. Philippe stated in an illustrated talk, given at the January dinner meeting. Mr. Philippe, who is director of the Rigid Pavement Laboratory of the U. S. Engineer Office, discussed the results of recent tests on experimental rigid pavements, using wheel loads up to 150,000 lb—comparable to the load of a B-36. He also touched upon the problem of constructing runways for planes weighing up to 800,000 lb, and the effect of various types of landing gear. During the evening, certificates of life membership were presented to A. H. Hinkle, H. D. Loring, and C. O. Sherrill.

CLEVELAND

PREDICTING THAT IN time we will be able to dial any telephone number in the United States from our own homes, Warren H. Chase, chief engineer of the Ohio Bell Telephone Co., explained and demonstrated progress in the transmission of voice at the annual meeting. By means of a receiving set, having an 18-in. whip antenna, Mr. Chase kept in touch with a telephone company car equipped with a wireless telephonic communication set and intercepted conversations between two cruising cars, which were 30 miles apart. During the evening, the "ASCE Wives" presented a cash scholarship award to W. B. Farmer, member of the Case School of Applied Science Student Chapter. The presentation was made by Mrs. Robert C. McDowell, president of the group. New officers for the Section, elected at the meeting, are: Arthur H. Stark, president; Wendell R. Swatosh vice-president; and Alfred D. Yanda, secretary-treasurer.

COLORADO

GUEST OF HONOR and principal speaker at the January 20 meeting was James B. Kenney, director of the Denver Building Chapter of the Associated General Contractors of America, who described the organization and functioning of AGC. In addition to serving the interests of contractors, Mr. Kenney said, the organization coordinates the efforts of other groups to establish uniform contract and bond procedure and uniform specifications. The AGC also works closely with the National Safety Council and has been instrumental in establishing safety practices in construction. A report on the Annual Meeting was given by A. J. Ryan, vice-president of the Section.

CONNECTICUT

PROBLEMS FACING THE Society were outlined by Albert Haertlein, ASCE Director for District 2, at the annual dinner meeting. Professor Haertlein also commented on the Annual Meeting of the Society, as did C. Mellen, president of the University of Connecticut Student Chapter. All the officers of the Chapter and of the Yale University Student Chapter had attended the Annual Meeting in New York as guests of the Section. During the evening, it was announced that James Murray Boyle and Herman Henry Smith have become life members of the Society, but they were unable to be present and receive their certificates in person. New officers for the Section, elected at this session, are: Philip G. Laurson, president; Francis L. Castleman, Jr., vice-president; and Harold L. Blakeslee, secretary-treasurer.

DAYTON

IN A TALK ON housing, given before the January luncheon meeting, O. W. Coffin, area expediter for Ohio for the National Housing Administration, presented a statistical picture of the reasons for the present housing shortage. According to Mr. Coffin, there has been a consistent decline in the number of housing units constructed since 1930, as compared to the 1921–1930 period, despite a population increase of 20,000,000. He estimated that it will be necessary to build 1,200,000 units a year for the next five years to provide adequate housing for the nation, and predicted that, with the availability of materials, the goal will be met. Other speakers were C. Russell Dole and Myron W. Tatlock, who reported the ASCE Annual Meeting, and John Hale, who discussed a proposed bill for the creation of a division of maps and surveys in the state department of public works, which is currently before the Ohio Legislature.

DISTRICT OF COLUMBIA

THERE ARE TWO fundamental reasons why there are so few engineers in public life, the Hon. Carl Hinshaw, Assoc. M. ASCE, Congressman from California, told the members of the Section at their annual dinner on January 28. These reasons are (1) that he does not know how to speak in terms that the public

MEMBERS OF ALABAMA SECTION and their guests gather on pier preparatory to making trip around Mobile Bay on ship *Dixie*. Trip was feature of recent annual meeting of Section, held in Mobile.

will understand, and (2) that he is often lacking in political, economic, and historical background. Speaking on "The Public Responsibilities of the Engineer," Mr. Hinshaw advocated requiring every engineering student to learn public speaking and debating, and to complete an undergraduate course leading to a B.S. degree before undertaking postgraduate work in engineering. The Congressman stated that it should be a matter of grave concern that so few engineers enter public life, and cited the fact that only four engineers—Washington, Grant, Jackson, and Hoover—have been President of the United States. The Section's guests for the occasion included ASCE President E. M. Hastings, Vice-President Gail A. Hathaway, and Director Howard T. Critchlow. Mr. Hastings spoke briefly on what he hopes to see accomplished during his term as President, commenting particularly on the proposals that Juniors be given a vote in Society affairs and that the annual dues be increased to permit the Society to function most effectively.

DULUTH

THE SALE OF electric power in northern Minnesota was reviewed by C. M. Baldwin, director of sales promotion for the Minnesota Power & Light Co., at a recent meeting. The use of power in the mines on the Mesabi Iron Range required considerable extension of the original system and increase in the number of plants generating power, Mr. Baldwin stated. It has been necessary to supplement water-power sources by coal-burning power stations, and future increases in demand must constantly be planned for. Several members of the Duluth City Engineer's Office were guests of the Section.

GEORGIA

A RECORD ATTENDANCE turned out for the February meeting, at which Dr. Poole Maynard, geologist and technologist for the Atlantic Coast Line Railroad, spoke on the development of Georgia's natural resources. In his analysis of the problem of recapturing the industrial wealth of the state, Dr. Maynard emphasized the need for a group to investigate, promote, and finance the development of the state's natural resources, pointing out that, because no such organizations are available, the industrial wealth of the state is being taken out of the state by more resourceful money-wise interests. In the discussion that followed, it was emphasized that engineers should play a prominent part in the investigation and planning of the industrial development program.

INTERMOUNTAIN

PRIVATE FLYING IN Utah is being delayed by lack of small airports, Oliver Johnson, assistant district engineer on Federal Airport Systems, told the members at a recent dinner meeting. Almost half a million dollars has been set aside for airport expenditure in the state in 1947, and engineers are trying to work out economical designs to use as standards in the future, he stated. Speaking at the same meeting, Erwin Moser, Section vice-president and engineer for the Civil Aeronautics Administration, discussed current operations in Utah. The state now has 52 airports, he said, but hopes to double that number within the next ten years.

KANSAS

NEW OFFICERS FOR the Kansas Section, elected at the annual dinner meeting on January 31, are: R. V. Smrha, president; A. G. Aldridge, vice-president; and John W. Frazier, secretary-treasurer. Several committee reports were presented during the business session, and the showing of a technicolor film on the Navajo Indians comprised the technical program.

LOS ANGELES

IN A TALK ON "Phases of Dam Design"—given at the January meeting—Wayne Perkins reviewed design and construction features that come to his attention in his capacity as inspector of dams for the California State Department of Public Works. The program for the occasion was arranged by the Junior Forum, and Donald R. Warren, president of the Forum, conducted the meeting.

LOUISIANA

JAMES E. JAGGER, Assistant Secretary ASCE, attended the annual meeting on January 25 and spoke on Society affairs currently before the Board of Direction, the proposed enfranchisement of Juniors, and the Board of Direction's recommendation that dues be increased. During the evening, certificates of life membership were presented to John T. Chambers, Harry C. Diesem, and W. H. Williams and, in absentia, to Frank W. Stephens and Walter C. Youngs. Other Section business included the passing of a resolution endorsing construction of the proposed tidewater canal connecting the port of New Orleans to the Gulf of Mexico. New officers for the Section, elected at the meeting, are: L. M. Odom, president; J. M. LeDoux, first vice-president; Walter Scales, second vice-president; and Bernhard Dornblatt, secretary-treasurer.

METROPOLITAN

NEED FOR LONG-RANGE planning of airports in the New York metropolitan area was emphasized by Col. Ora W. Young, CAA regional administrator, before a group of 400 at the February meeting of the Metropolitan Section. Colonel Young's address was supplemented by a symposium of papers by three members of his staff—William A. La Rue, superintendent, ANF Operations Branch; Herbert M. Toomey, acting superintendent, Aircraft and Components Branch; and William Cullinan, superintendent, Airports Branch. Mr. Cullinan stated that a fourth major airport in the metropolitan area will be necessary within a few years. Air passengers for the New York area, according to the Regional Plan Association, are expected to total 4,000,000 this year, 17,000,000 in 1950, and 32,000,000 in 1960.

MIAMI

TEMPORARY DAMS IN six tidal canals have had a twofold effect against the inland intrusion of salt water, John C. Stephens, engineer in charge of the Dade County Division of Water Control, told members of the Section. Speaking before the January dinner meeting, Mr. Stephens pointed out that the dams have halted the westward movement of salt water in the canals and, at the same time, have raised fresh water levels to prevent underground intrusion. He cited overdrainage by canals as the cause of the water-control problem, and stated that the county's major project is the construction of a dam and locks in the Miami River.

MID-MISSOURI

GUEST OF HONOR and principal speaker at a recent dinner meeting was ASCE Director Harry F. Thomson, who led a discussion of present and proposed policies of the Society. Reporting for the Section's Committee on Student Chapters at the same meeting, E. W. Carlton stated that the present over-crowding in the engineering schools and consequent tax on accommodations and teaching staffs have made it difficult to acquaint students with Student Chapter aims and purposes. Nevertheless, he said, the Chapters at both the University of Missiouri and the Missouri School of Mines are having an active and good year.

MONTANA

A RECENT MEETING was devoted to discussion of the Engineers' License Law. Keen interest was shown in the subject, as Montana is one of the few states that do not have a compulsory licensing law. An appeal was made to those present to bespeak the case for engineers' registration at every opportunity, and to get professional and lay groups to adopt resolutions favoring such legislation. New officers for the Section, elected on January 31, are: Paul M. Johnson, president; Fred Ernest Thieme, first vice-president; Wilbur S. Hanna, second vice-president; and Edward H. Thomas, secretary.

NEW MEXICO

ABOUT 50 ENGINEERING STUDENTS, including the entire Student Chapter at the University of New Mexico, swelled the attendance at a recent meeting, which was held on the university campus. Trends in laws governing registration of engineers were discussed by G. B. Drummond, assistant state engineer of New Mexico, who reported on the St. Louis meeting of the State Boards of Engineering Examiners. The technical program consisted of an illustrated talk on the subject of mining potash in New Mexico. During the evening, the following new officers were elected: E. B. Bail, president; George Johnston, first vice-president; C. S. Howard, second vice-president; and Bernard C. Moore, secretary-treasurer. At the conclusion of the meeting, members of the Chapter served refreshments.

NORTH CAROLINA

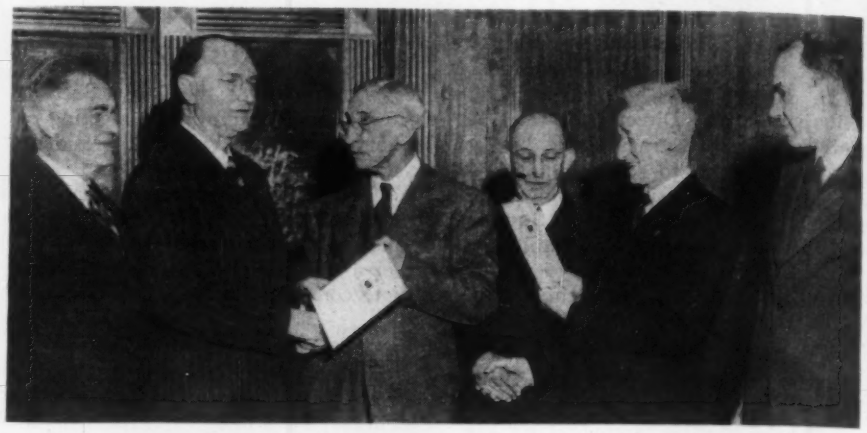
A FULL PROGRAM of technical speakers had been arranged for the all-day annual meeting, which took place in Raleigh on January 10. Speakers at the morning session were Fred E. Schepfe, director of the Flight Strips Division of the Public Roads Administration, who discussed the flight strips program of the Administration, and William T. Martin, cost accountant for the Carolina Steel and Iron Co., of Greensboro, whose topic was applications of cost accounting. At the noon luncheon meeting, T. S. Johnson spoke on urban redevelopment, emphasizing the need for long-range planning for future city extensions. A symposium on the work of the State Board of Health Commission on State Stream Conservation and Sanitation constituted the afternoon technical program, the speakers being Capus M. Waynick and E. D. Burchard. The list of distinguished guests included ASCE Director William M. Piatt, who gave the concluding address of the afternoon. As chairman of the Committee on Changes in the Constitution, Mr. Piatt stated that copies of the proposed changes have been sent to all members qualified to vote, and explained the desired changes. The annual election of officers resulted as follows: N. P. Hayes, president; R. E. Stiemke and E. D. Burchard, vice-presidents; and G. H. Maurice, secretary-treasurer.

NORTHWESTERN

GUEST OF HONOR and principal speaker at the February 3 meeting was William N. Carey, Executive Secretary of the ASCE. Lorenz G. Straub, chairman of the Section's committee on Engineers Joint Council, explained briefly the make-up of EJC and then introduced Colonel Carey, who reviewed the activities of the organization and outlined progress it has made to date in establishing engineering as a profession. In the enthusiastic open forum that followed Colonel Carey's talk, discussion ranged from proposed changes in the Wagner Act to cooperation with the National Society of Professional Engineers, giving the membership an idea of the progress being made by engineers along lines other than technical. During the meeting, the Section passed on to its Committee on Employment Relations a resolution urging that engineers be guaranteed, under amended provisions of the Wagner Act, complete freedom to join or to refrain from joining any labor organization.

OREGON

AT THE ANNUAL dinner meeting, which took place in Portland in January, certificates of life membership were presented to Robert W. Lemen and Lawrence K. Needham. The meeting took on the aspects of a railroad fraternity convention, both recipients being veteran railroad engineers, as are Samuel Murray and Carl Thomas, who made the presentations. The principal speaker of the evening was Dr. Morgan Odell, president of Lewis and Clark College, who discussed the philosophy of John Muir, naturalist and writer. At the conclusion of the program, Bernhardt E. Torpen, retiring president of the Section, presented the gavel to his successor, Norbert H. Leupold, of the Leupold and Stevens Instrument Co. The other new officers elected are. Glenn S. Paxson, first vice-president; Theron W. Ragsdale, second vice-president; Glenn Taylor, secretary; Thomas M. Davis, treasurer; and Claire G. Tittle, assistant secretary.



AT ANNUAL DINNER MEETING OF OREGON SECTION two members receive certificates of life membership. Reading left to right: Bernhardt E. Torpen, retiring president of Section; Robert W. Lemen, special representative of Pacific Greyhound Lines; Samuel Murray, resident engineer, Union Pacific Railroad Co.; Carl F. Thomas, chief engineer, Spokane, Portland & Seattle Railway Co.; Lawrence K. Needham, resident engineer, Spokane, Portland & Seattle Railway Co.; and Norbert H. Leupold, newly elected president.

OKLAHOMA

THE POSSIBILITY OF dividing the Section into two branches for the convenience of the members was discussed at considerable length at the first meeting of the year—held in Oklahoma City on January 10 in connection with the twelfth annual convention of the Oklahoma Society of Professional Engineers. A motion to canvass the Section by questionnaire was made and passed. A feature of the occasion was the presentation of a certificate of life membership to William E. Price. A talk by Norman Flaigg on the irrigation and other activities of the U.S. Bureau of Reclamation in Oklahoma concluded the program.

PITTSBURGH

THE LOCATION AND economics of the proposed Ohio River–Lake Erie Canal were discussed by Col. W. E. Lorence at a recent joint meeting with the civil section of the Engineers' Society of Western Pennsylvania. Preceding the joint session, the Pittsburgh Section entertained at dinner for its new life members—A. C. Ackenheil, T. R. Beeman, and H. A. D. Saurbrey—to whom certificates were presented. The fourth recipient, E. J. Ellsworth, was unable to attend and had been given his certificate in advance. Guests of the Section included Harland C. Woods, of Buffalo, newly elected ASCE Director.

PROVIDENCE

A RÉSUMÉ OF the varied problems currently facing the Board of Direction was given by ASCE Director Albert Haertlein at the January dinner meeting. Professor Haertlein also discussed briefly the projected joint meeting of the Connecticut, Northeastern, and Providence Sections, to be held in the spring. He was followed by Harold Putnam, of the *Boston Globe*, who described a recent trip to

South America, illustrating his talk with Kodachrome slides.

PUERTO RICO

At the recent annual dinner meeting, a certificate of life membership was given to Carl A. Bock, chief engineer of the Puerto Rico Water Resources Authority. New officers for the Section are: Miguel A. Fernandez, president; Felix A. Leon and Werner Wilkens, vice-presidents; and Raoul N. Arroyo, secretary-treasurer.

ROCHESTER

Pending national and state legislation was discussed at the January meeting. As a result of the discussion, the Section voted to endorse two amendments to the New York State Education Law; to urge modification of the Wagner Act; and to oppose the Bloom Bill, which would enable the government to furnish engineers to foreign countries. During the business session, the following new officers were elected: Cecil Aronson, president; Henry G. Lehrbach, first vice-president; Robert R. Sheridan, second vice-president; and Herbert P. Kopf, secretary-treasurer. The showing of films on the construction of prestressed concrete tanks and earth movers, made by the Navy during the war, concluded the program.

SACRAMENTO

Unique difficulties experienced in designing hydraulic structures in Algeria were described by Bernard Chatenet, Algerian engineer, at a recent luncheon meeting. According to Mr. Chatenet, the Arabs drill holes in the bottoms of flumes to get more water, or pry apart sections of a canal in order to obtain the rubber-expansion joints for making beds. At the same session, Gerald H. Jones, retiring president, reported on the progress of engineering during his tenure. The speaker at another luncheon was L. S. Hall, principal hydraulic engineer for the East Bay Municipal Utility District, who discussed air entrainment in water. New officers for the Section, elected on January 14, are: Stewart Mitchell, president; Henderson McGee, second vice-president; and Wilbur Robison, secretary.

ST. LOUIS

Reconstruction of the vehicular deck of the Eads Bridge involved replacement of 90 percent of the old steel and wrought iron floorbeams—originally placed by Eads himself—with timber stringers and decking, Newel J. Law, Jr., told members of the Section at their January luncheon meeting. Mr. Law, assistant bridge engineer of the Terminal Railroad Association of St. Louis, touched on salient features of the design and construction of the bridge, stating that it was the first American bridge in which steel was used extensively. For the first time, also, Eads made use of the modulus of elasticity and elastic limit in the steel specifications. Costs and length of time required for reconstruction of the vehicular deck were increased, Mr. Law pointed out, by the necessity of keeping two highway lanes and one railroad track open at all times, and a second track open except during working hours.

SPOKANE

Problems arising in connection with the schooling of the many war veterans enrolled in Pacific Northwest colleges and universities were discussed at the annual dinner meeting. Taking part in the symposium were Prof. G. A. Riedesel, of the University of Idaho; Prof. H. E. Phelps, of Washington State College; and Prof. R. E. Tobin, of Gonzaga University. T. R. Hance, who had previously been appointed to work with a committee of the Washington Society of Professional Engineers on proposed revisions of the Washington State Licensing Law, explained the proposed amendments. The Section then went on record as endorsing the proposed changes in the existing law. Presentation of a certificate of life membership to John S. Swan, and election of officers concluded the meeting. The new officers are: William P. Hughes, president; Harold J. McCoy, first vice-president; Allen S. Janssen, second vice-president; and William A. Hill, secretary-treasurer.

TACOMA

Principal speaker at the annual stag social was C. A. Ecklund, of the Sacramento Section, who described the activities of his Section. During the business session, Charles E. Andrew was elected president; John L. Stackhouse, vice-president; and Horace J. Whitacre, Jr., secretary-treasurer. The formalities dispensed with, members and their guests then settled down to an evening of penny-ante and bridge.

TENNESSEE VALLEY

The economic use of metallic materials of construction was discussed at the February meeting of the Knoxville Sub-Section by John C. Robison, assistant chief, Y-12 operations, Electromagnetic Isotope Separations Plant, Atomic Energy Commission, Oak Ridge, Tenn. Stating that many of the so-called economies practiced in the use of such materials of construction, in World War I, proved to be very costly, Mr. Robinson pointed to the necessity of basing choice of materials on initial cost, life expectancy, and cost of maintenance.

Principal speaker at the Chattanooga Sub-Section's January dinner and smoker was F. M. Bell, chief of the Chattanooga office of the Water Resources Branch of the U. S. Geological Survey. Mr. Bell, who recently returned from making a survey of the water resources of Japan, described the deficiencies in oil and coal that have necessitated the development of extensive hydroelectric projects there.

TEXAS

Organization and operation of the Fort Worth Water Department were described by Uel Stephens, superintendent of the Fort Worth Water Works, at the January luncheon meeting. Following his talk, J. K. Alewine reported on water consumption at Houston, Tex., during the recent cold spell.

TRI-CITY

There was an attendance of over a hundred at the January joint meeting with local groups of the American Society for Metals and the American Society of Mechanical Engineers. Speaker of the evening was J. W. Halley, chief research engineer for the Inland Steel Co., of Chicago, who discussed low-alloy high-strength steel. Section members attending the meeting had an opportunity to get acquainted with George S. Salter, Midwest Representative of the ASCE.

STUDENT GROUP IS briefed before inspecting Moorman's River dam, feature of student conference held at Charlottesville, Va., in late fall. Participating Student Chapter Groups are: Virginia Military Institute, Virginia Polytechnic Institute, and University of Virginia.

NEWS BRIEFS

ABOUT ENGINEERS AND ENGINEERING

Fewer Controls, More Housing Is Aim, Say Housing Chiefs

SOME CONTROLS on housing are being relaxed in order to further the aim of more and cheaper housing in 1947, according to a statement issued by Frank R. Creedon, Housing Expediter, and Raymond M. Foley, National Housing Administrator. Quotations from the statement follow:

"The objectives of the 1947 housing program are to obtain the greatest possible number of dwelling units at moderate cost and to enable veterans to obtain housing that best meets their needs, particularly homes for rent. Government assistance and controls are therefore being continued wherever they are necessary and will result in more housing. Controls are being relaxed only when relaxation will contribute effectively to the year's housing objectives.

"The 1947 program differs from the program for 1946 because the conditions under which it operates are different. We believe that we are adjusting the program to realities. We have not and will not change its purposes.

"A year ago large-volume residential construction was impossible because building materials simply were not available in quantity. To increase the supply of materials and to insure their use in housing, government controls and assistance were essential. During 1946 we have seen materials production rise to a high level and home building reach the point where 1,000,000 housing units were put under construction in a year's time.

"But the problem is by no means solved. The supply of many materials has not yet caught up with requirements. Therefore, energetic efforts to maintain and increase production are still required, and controls are still needed to insure that building materials produced will be used in home building. The prospects for meeting these difficulties are far brighter today than they were a year ago.

"We now urgently need not only to increase the volume of home building, but also to speed the completion of homes and shorten the building time in order that construction costs may be reduced.

"Accordingly, the removal or modification of controls which no longer fit the current situation is essential. Controls as such are intricate and burdensome, both to builders and to the government. In themselves they impose an added burden on producers, distributors, and builders and the government that add to the time and cost of construction. Where the building and completion of homes will be speeded and made easier, controls are being relaxed."

Examination Scheduled for Navy C.E. Corps Billets

CIVIL ENGINEERS seeking appointment as junior grade lieutenants in the Navy Civil Engineer Corps, Bureau of Yards and Docks, will have the opportunity to take an examination in May, scheduled after the Bureau received indications that many applicants failed to get adequate notice for the test given in February. In all, 70 billets are open.

Candidates must be between 22 and 30 years old, must be graduates of an accredited engineering college or university, must have had three years' professional experience in engineering or related active military service, and must be citizens of the United States. Those who will have completed the three years' experience by July 1, 1947, may be accepted.

The examination, requiring two days, will test general engineering knowledge. Applicants can get full details from the Naval Officer Procurement office in their areas.

Investigations of Ohio Water Board Published

VARIOUS PHASES OF the extensive program of water-resources investigations, on which the Ohio Board of Water Resources is currently engaged, are described in the Fifth Annual Report of the Board. Regional investigations in areas where water problems were most urgent have already been made, the most extensive having been in the Canton area and in Butler and Hamilton counties. These and other regional investigations now in progress are summarized in the report, which may be obtained from the Ohio Water Resources Board at Columbus, Ohio.

Construction of $17,500,000 Bus Terminal Approved for New York City

CONSTRUCTION OF A NEW $17,500,000 union bus terminal by the Port of New York Authority to connect with the Lincoln Tunnel by overhead ramps will be a major step in relieving traffic congestion in mid-Manhattan. Scheduled to be completed within two years, the new bus terminal will, in time, replace the individual terminals now scattered throughout the city. Thus, the movement over midtown streets of 2,500 intercity buses that enter and depart from the heart of New York daily will be eliminated. The terminal will serve 60,000 bus commuters who travel between New York and New Jersey daily. Its central location, within a short walk of Times Square, will permit bus passengers to reach important business, amusement and shopping centers by subway and surface transportation.

Society Member's Speech on City Planning Problems Published

"First Aid for Sick Cities," a talk by Leslie Williams, secretary of the executive committee of the Society's City Planning Division, before the West Virginia State Development Conference, Charleston, W.Va., appears in full in the January 15 issue of *Vital Speeches of the Day*, a publication that reports important addresses of recognized leaders of public opinion. The following remarks keynoted Mr. Williams talk.

"Our cities are full of infirmities. They are congested. Around the central business core is a ring of blight. Even our middle-aged residential areas are riddled with vacant lots yet lack adequate space for recreation. A frowzy fringe of junk yards, honkey-tonks and papier maché villages meet the eye of the visitor as he is approaching our communities.

"If business men and public officials will unite on a comprehensive program of objectives such as:

- Decongesting and revitalizing the downtown
- Clearing the slums and redeveloping the areas
- Protecting existing residential neighborhoods
- Guiding appropriate outlying growth
- Rationalizing the tax base and financial structure of the metropolitan area
- Educating the public to the evils of decentralization
- Coordinating the views of public officials and business interests on a Master Plan of the Metropolitan Area

—then their first few steps will be firmly planted in the right direction toward a goal assuring the greatest good to the greatest number of Americans.

"The circulation of people and merchandise is the life-stream of the city. Whatever impairs the circulation of people and goods impairs the value of land and property within the city. Traffic congestion impairs the accessibility of the downtown and is a major cause of the loss of millions of dollars of values in our central business districts.

"Therefore, transportation is a good starting point in which to consider improvements.

"Most cities suffer from two daily attacks of traffic congestion in the business center. The more acute attack comes every night at 5:00 p.m. from Monday through Friday. It is preceded by a smaller attack between 1:00 p.m. and 2:00 p.m. The 5:00 p.m. attack is a problem of dangerously high pressure on the arteries; the 2:00 p.m. congestion is a tension within the off-street terminals.

"Both are interrelated, and remedial measures should be applied selectively, in the right amounts and at the right place and times, on a basis of fact and not fancy."

Mr. Williams emphasized that "when all of the groaning and inflammation has been penetrated, the technical treatment is as simple as *ABC:*

(*A*) Distribute traffic over more time.
(*B*) Secure maximum use of existing streets and transit facilities.
(*C*) Provide additional space for movement and storage of the vehicles which carry the people and goods."

National Committee for Traffic Safety Will Meet

A review of progress in the field of public support of recent traffic-safety programs and a forecast of future work will be presented at the annual meeting of the National Committee for Traffic Safety. The meeting is to be held at the Hotel Statler, Washington, D.C., on March 14, at 10:15 a.m.

Several members of the ASCE are scheduled to speak. The list includes Maj. Gen. Philip B. Fleming, chairman of the President's National Highway Safety Conference, and Thomas H. MacDonald, Hon. M. ASCE, commissioner of the Public Roads Administration.

Harvard Engineering Society Has 100th Anniversary

Celebrating the 100th anniversary of the beginning of engineering instruction at Harvard University, the Harvard Engineering Society held a special dinner meeting at the Harvard Club in New York on February 13. The list of speakers for the occasion included Gordon M. Fair, M. ASCE, dean of the faculty of engineering at Harvard. Dean Fair is chairman of the executive committee of the ASCE's Sanitary Engineering Division.

During the cocktail hour preceding the meeting, members of the Harvard Engineering Society and their guests drank a toast "to the scientific accomplishments of the past and to the hopes for the future."

New Edition of "Who's Who in Engineering" Compiled

The sixth edition of *Who's Who in Engineering*, official biographical dictionary of the engineering profession, now is being compiled after consultation with the advisory committee of Engineers Joint Council. Revision is being undertaken at the present time in order to record the peacetime activities of the engineering leadership.

ASCE members on the advisory committee of EJC on *Who's Who in Engineering* are Col. William N. Carey and T. Keith Legaré. This committee has established the qualifications for inclusion in the volume. Engineers must qualify in one of the following groups:

1. Engineers of outstanding and acknowledged professional eminence.
2. Engineers of at least ten years' active experience, of which at least five years have been in responsible charge of important engineering work.
3. Teachers who have taught engineering subjects in colleges or schools of accepted standing for at least ten years, of which at least five years have been in responsible charge of a major engineering course in such college or school.

Military assignments will have proper consideration in Groups 2 and 3.

Davis Undergraduate Welding Award Offered for 1947

Four cash prizes totaling $700 make up the 1947 A. F. Davis Undergraduate Welding Award, given to authors and publications for the two best articles on welding published in undergraduate magazines between July 1, 1946, and April 1, 1947. A prize of $200 will go to the author or authors of the best article on welding and a similar award of $200 to the publication in which the article appears. The author or authors of the second best article will receive $150, as will the publication that prints it.

Particular attention is directed to the time limit of April 1, a change from the previous closing date of July 1.

Papers will be judged by a group selected by the American Welding Society, on the basis of originality of subject, originality and clarity of presentation, and thoroughness of presentation. Funds for the awards were donated to the society by A. F. Davis, vice-president and secretary of the Lincoln Electric Co.

Engineering College Research Group Issues Proceedings

Overhead charges on sponsored research in colleges of engineering have been reviewed by research directors of six major engineering schools in the 1946 Proceedings of the Engineering College Research Association. Two other papers—"Needs for Engineering Biographies," by N. W. Dougherty, M. ASCE, and "Training of Research Engineers," by Dr. J. R. Van Pelt—and a complete record of the activities of the Association from 1944 to 1946 also appear in the 76-page publication.

The regular price of the Proceedings is $1, and orders should be addressed to the Association at the College of Engineering, State University of Iowa, Iowa City, Iowa.

American Welding Society Schedules March Meeting

The American Welding Society has scheduled a four-day meeting for March 24–27, inclusive, during the Western Metal Exposition and Congress to be held at Oakland, Calif., from March 22 to March 27. The program for the AWS meeting includes 15 papers by welding engineers on the various types of welding and their practical applications.

Construction Industry Sets Up Building Research Board

JOHN C. STEVENS, Past-President ASCE, chairman of the Construction Industry Advisory Council, has announced that the National Research Council has agreed to set up a Building Construction Research Board to serve as a clearing house of technical research information in the field of building construction. This decision was reached at a conference with Dr. Frank B. Jewett, president of the National Academy of Sciences, and Dr. D. W. Bronk, chairman of the National Research Council of the Academy.

The new board will be patterned after the existing Highway Research Board; its principal function will be to collect and disseminate technical research information of importance to the building industry. It will also provide a meeting place at which those actively engaged in research activities will be able to exchange ideas, and a mechanism for the correlation of activities carried on simultaneously by several organizations. No direct laboratory activity is contemplated.

The proposal to establish a Building Construction Research Board was advanced at a recent meeting of the Construction Industry Advisory Council, composed of more than 100 trade and professional associations with a direct interest in construction. It will be supported by contributions from the industry. A meeting of construction industry leaders will be called in the near future by the Division of Industrial and Engineering Research of the National Research Council to determine acceptable procedure for setting up the new organization.

$2,000 in Prizes Offered for Papers on Resistance Welding

CASH PRIZES totaling $2,000 will be awarded by the Resistance Welder Manufacturers' Association, for outstanding papers dealing with resistance welding subjects. Contest judges will be appointed by the American Welding Society, and awards will be made at the 1947 fall meeting of that society. The contest will close at midnight, July 31, 1947.

One prize of $750 will be awarded for the best paper emanating from an industrial source, consulting engineer, private or government laboratory, or the like, the subject matter of which is concerned specifically with resistance welding. There are no other restrictions on subject matter. For example, the paper may be devoted to redesign of a product or products for resistance welding, improvement (from a welding and cost viewpoint) in a present design for resistance welding, resistance welding research, development of new procedures to broaden the field of application of resistance welding, etc. A prize of $500 is offered for the second best paper from an industrial source, and a prize of $250 for the third best.

A prize of $300 will be awarded for the best paper emanating from a university source, that is, either an instructor, student or research fellow; and a prize of $200 for the second best paper from such a source.

Address the American Welding Society, 33 West 39th Street, New York 18, N.Y., for further information.

Revival of National Science Legislation Is Held Likely

OF INTEREST TO ASCE members who unsuccessfully backed a National Research Foundation bill in the 79th Congress are the following statements:

"The War Department fully realizes that if it is to stay ahead of its competitors, it must maintain close association with scientists. We (the U.S.) are greatly in need of an official agency of science with which to maintain this contact. The War Department is highly desirous of having Congress establish a National Science Foundation at as early a date as possible."

These statements were made by Maj. Gen. H. S. Aurand, War Department Director of Research and Development, at the recent joint annual meeting of the American Physical Society and the American Association of Physics Teachers at Columbia University, New York.

General Aurand's statements were interpreted by those interested in revival of the legislation establishing a National Science Research Foundation as indicating that the 80th Congress will act favorably on such legislation during its current session.

On October 26, 1945, a panel appointed by Engineers Joint Council and representing the five constituent societies of EJC—ASCE, AIME, ASME, AIEE and AIChE—appeared before a Senate committee and advocated inclusion of representatives of the engineering profession in the foundation then under consideration. (See CIVIL ENGINEERING for December 1945, page 572) Dr. Boris A. Bakhmeteff, Honorary Member ASCE, represented ASCE and was chairman of the panel.

General Aurand delivered the principal address on the opening day of the ASCE Fall Meeting in Kansas City last October. (See CIVIL ENGINEERING for November 1946, page 475.)

Slab Under Bridge Rocker Shoe Tested at Northwestern

SAFER AND CHEAPER highway and railroad bridges may be possible as the result of a series of unique tests under way at the Technological Institute of Northwestern University. The purpose is to discover for the first time exactly how much steel is necessary for safe construction of a commonly used type of steel bridge support.

In the tests a steel support for a 150-ft bridge span is placed in the giant transverse-universal press in Northwestern's materials testing laboratory and subjected to more than a half million pounds of pressure—the span's maximum load—to determine the exact amount of stress in each of its parts.

The support is known as a rocker shoe because of its rocking motion, which allows a 150-ft steel bridge span or truss to expand and contract several inches in hot and cold weather. As the shoe rocks, its weight shifts on a supporting steel slab that must be thick enough to prevent cracking of the underlying concrete abutment. In the tests, stresses in all parts of the slab are measured by electrical wire gages attached to 180 two-inch square steel blocks supporting the slab. Each block measures the stress in its area.

The tests were devised and are directed by Maurice B. Lagaard, M. ASCE, associate professor of civil engineering at Northwestern. The bridge supports were built by Bethlehem Steel Co. for the Chinese government, which lent them to Northwestern for the tests.

Pumping of Concrete Pavements Is Studied

SPECIAL PAPERS ON the pumping action of concrete pavements—resulting from a recent survey of the pumping of concrete pavements in North Carolina and Kansas—have been published by the Highway Research Board as the 1946 supplement to Research Reports No. 1 D, under the sponsorship of the Committee on Maintenance of Joints in Concrete Pavements as Related to the Pumping Action of the Slabs.

The two papers comprising the 67-page mimeographed supplement are "Pumping of Concrete Pavements in North Carolina" and "Pumping of Concrete Pavements in Kansas." In the first of these studies, approximately 300 miles of concrete pavements on main traffic routes were surveyed. The survey consisted of (1) classifying and counting pumping joints and cracks to determine location and extent of pumping in terms of damage to the pavement; (2) examining in detail short sections of pumping slabs; and (3) sampling and testing of soils from under pumping and non-pumping slabs. The second study—covering 237 miles of concrete pavement on the most heavily traveled roads in Kansas—was made to assess the degree and extent of pumping during the spring wet weather season.

Both surveys were a cooperative project of the respective state highway departments and the Portland Cement Association.

Tool Engineers Plan Annual Meeting in Houston, Texas

"MORE GOODS, FOR MORE PEOPLE, for less money, while paying higher wages" is the theme of the technical sessions scheduled to be held coincidently with the 15th Annual Convention of the American Society of Tool Engineers, March 19–22, at Houston, Tex. Many prominent speakers are on the program.

Information as to the meeting may be secured from John M. Cannon, Director of Public Relations, American Society of Tool Engineers, 1666 Penobscot Building, Detroit 26, Mich.

R. Robinson Rowe, M. ASCE

"NOAH, THE PROBLEM assigned for tonite would have been much more interesting if given a glamorous setting, say a beach instead of a forest. Then if dames had an average diameter of 2 ft and were scattered 200 to the acre, how far could a man see?"

"That would be ambiguous, Joe, and the solution would involve a lot of figures. Besides, this problem was contrived by Tim Burr, our Guest Professor, who feels more at home in the woods. Don't you Tim?"

"Just so, but if Joe Kerr can answer his diversion, let's hear it."

"All right, Professor Burr. I drew concentric circles about my eye as a center with radii determined by $\pi r^2 m = n$, where $n = 1,2,3 \ldots$ and $m = 200/43{,}560$, the density of dames. There should be one dame in the inner circle and one in each annulus. Then I rotated the annuli until the dames, in order of proximity, were arrayed in radial echelon (see sketch) forming sort of a spiral

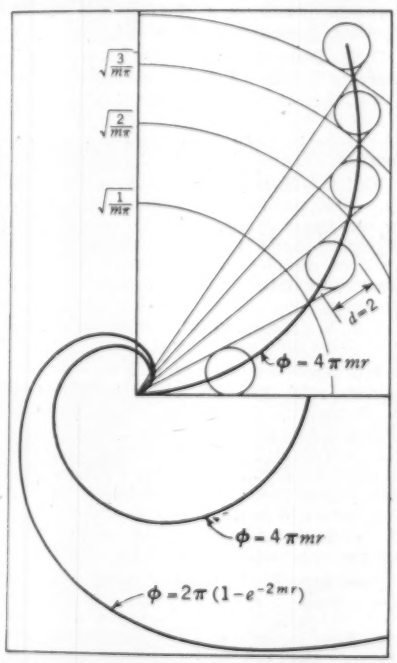


FIG. 1. PROBABILITY SPIRALS are enlarged in first quadrant to show construction.

curve. I planimetered the area inside one spire, finding 0.21 acre, which is equivalent to a circle with a radius of 54 ft. So that's how far I could see on the average on the beach."

Al E Dayde held up his hand. "Why planimeter an Archimedean spiral? From the sketch, Fig. 1, it is evident that

$$r\,d\phi = 2\,dn$$

and differentiating Joe's radius formula:

$$2\pi m r\,dr = dn$$
$$d\phi = 4\pi m\,dr$$
$$\phi = 4\pi mr$$

Then as ϕ varies from 0 to 2π, r varies from 0 to $\frac{1}{2m}$ and averages $\frac{1}{4m} = 54.45$ ft."

"The dames have led Joe and Al astray," cracked Cal Klater, "by posing so as not to be half hidden by other dames. Professor Burr's trees are different. The portion of each tree probably hidden behind nearer trees is the ratio of ϕ to 2π, so:

$$d\phi = 4\pi m \frac{2\pi - \phi}{2\pi} dr = 2m(2\pi - \phi)dr$$

$$\phi = 2\pi(1 - e^{-2mr})$$

$$d\phi = 4\pi m e^{-2mr} dr$$

$$\rho = \frac{1}{2\pi}\int_0^{2\pi} r\,d\phi = 2m\int_0^{\infty} re^{-2mr}\,dr$$

$$= 2m \cdot \frac{1}{4m^2} = \frac{1}{2m} = 108.9 \text{ ft.}$$

Then, if you want to be academic, we can subtract $\frac{1}{4}\pi$, the average depth of tree between observer and spiral, for a final answer of 108.12 ft."

"All I can say, Noah, is that Cal has the answer. He surely knows his exponential monospires."

"Thanks, Tim. It's an interesting curve that I never met before. Coming back to realities, Ken Bridgewater has been telling me of his estimate for the proposed Friscoak Toll Bridge and his plan to amortize 2% bonds with anticipated revenues of $4,000,000 per annum. His Chief, mindful of inflationary trends, said, 'Double everything!' Ken did—estimate, interest rate, revenues and amortization period. What was his estimate?"

[*Cal Klater was A Nuther Nutt, the inimitable anonymity. Our Guest Professor Burr was Charles F. Ruff. The host of Joe Kerrs preferred answers over 200. Novel constructions for the December drafting problem came late from A Nuther Nutt and May B. Masce (J S Kendrick).*]

Is Theory of Gravity World's Biggest Hoax?

AT TIMES some of the subtle humor and jocular comments that spice the technical mental gymnastics featured in N. G. Neare's column creep into other discussions submitted by learned ASCE members. There are times too when the jocular element dominates the technical aspect of the contribution. This is true in the following "scientific" treatise submitted by "Anne Othernut," a frequent contributor to the aforementioned column.—*Editor.*

It is of more than passing importance to me that one of the great scientists of the past pulled a fast one for purely personal glory. When Sir Isaac Newton was conked by an apple he may have been knocked crazy, but not that crazy. In other words his idea of "gravity" is but a hoax. There is no such thing and he must have known it.

Let us take for example his own illustration, the pull on the moon (incidentally it took him forty years to work up nerve enough to publish his contentions).

I compute the magnitude of this pull as follows:

Alleged data: Diameter of earth, 8,000 miles; distance to moon, 240,000 miles or 60 radii of earth, mass of moon $^1/_{80}$ that of earth; specific gravity of earth, 5.58 or 348 lb per cu ft. Volume of earth:

$$\frac{4\pi r^3}{3} = \frac{(4{,}000)^3\,(4)\pi}{3} =$$

$$(2.68)\ (10)^{11} \text{ cu miles or}$$

$$(3.94)\ (10)^{22} \text{ cu ft}$$

Weight of moon in pounds at earth's surface:

$$\frac{(3.94)\ (10)^{22}\ (348)}{80} = (1.718)\ (10)^{23}$$

Pull on moon =

$(1.718)\ (10)^{23} \div (60)^2 = (4.775)\ (10)^{19}$ lb, which is a lot of lb.

Let us figure the diameter of a steel cable strong enough to pull the moon back in its orbit. Assume the steel stressed to 30,000 psi or 4,320,000 psf. The area of this cable must then be $(1.105)\ (10)^{13}$ sq ft. Since, for a circle, $A = \pi r^2$, the required radius^2 must be:

$$r^2 = \frac{(1.105)\ (10)^{13}}{\pi} = (3.515)\ (10)^{12} \text{ and}$$

$$r = (1.875)\ (10)^6 \text{ ft}$$

this is $(3.551)\ (10)^3$ or 355 miles radius; 710.2 miles in diameter. Leaving off the 0.2 for safety we have 710 miles diameter. The weight of the cable can be disregarded since it has just been proved that gravity (therefore weight, which is $g \times m$) is nonexistent.

I have observed the moon and have yet to see such a cable. People have traveled all over the world and do not point out meeting with any resistance (except in Germany and Japan before VE-day). So I question the whole theory and think if Newton were here today he would be held strictly accountable or be asked to furnish definite proof of the veracity of his loose statements.

I offer, as an alternative suggestion, that the moon follows its orbit from habit. There is nothing stronger than habit, not even steel, and it is often transparent, as is this cable (or should I say fable?).

Civil Engineering Subjects Covered in ASA Price List

CIVIL ENGINEERING AND construction subjects are covered in a Price List of American Standards, issued by the American Standards Association as Part 2 of the January number of *Industrial Organization*, monthly publication of the ASA. A complete index to the list of American Standards is included in the 23-page supplement.

Those wishing to purchase the price list should get in touch with the American Standards Association, 70 East 45th Street, New York City. The cost of the list is 35 cents.

Modular Coordination Receives $65,900 Grant

SAVINGS IN CONSTRUCTION costs arising from the adoption of modular coordination in the manufacture of building products will become available to the public more quickly as a result of the $65,900 grant made to the Modular Service Association by the Office of Technical Services of the Department of Commerce, according to a recent announcement by Tyler S. Rogers, president of the Producers' Council.

"The funds will be used to expand and intensify research in methods of coordinating the dimensions of building products in such a way as to eliminate need for cutting and fitting materials on the building site, thus permitting important savings in both time and materials," Mr. Rogers said. "There also will be further savings in the manufacture and distribution of modular materials," he pointed out. "These added savings will result from a greater degree of mass production and from lower inventory costs."

Plans for Fire Prevention Conference Are Completed

AN AVERAGE OF 10,000 deaths a year and a mounting property loss, exceeding 56 million dollars in 1946—such is the toll taken by fires in the United States and the reason behind President Truman's sponsoring of the President's Conference on Fire Prevention, which is scheduled for May 6–8 in the Departmental Auditorium in Washington, D.C.

In cognizance of his experience as chairman of the President's Highway Safety Conference, held last May, President Truman has appointed Maj. Gen. Philip B. Fleming, M. ASCE, Federal Works Administrator and Administrator of the Office of Temporary Controls, to be general chairman of the fire prevention conference. W. E. Reynolds, M. ASCE, Commissioner of Public Buildings, Federal Works Agency, has been named chairman of the Coordinating Committee; and A. Bruce Bielaski, assistant general manager of the National Board of Fire Underwriters, has been named executive director.

"The Highway Safety Conference found that education, enforcement and engineering are the keys to highway safety," General Fleming said. "I believe these 'three E's' also are the keys to fire prevention. We need widespread education in methods of fire prevention and control, more adequate laws and their rigid enforcement, and better engineering to make buildings fire resistant."

Committees will make advance studies of special aspects of the problem, including enforcement, law revision, building codes, inspection, fire-fighting services, education and publicity. More than 2,000 delegates are expected to attend, representing federal departments, state, county and municipal governments and business and civic organizations with a basic interest in the problem. Conference headquarters is Room 7006, Federal Works Building, Washington 25, D.C.

Engineering Societies Library Compiles List of Important Books for Civil Engineers

A LIST OF SOME IMPORTANT books of interest to civil engineers has been compiled by the staff of the Engineering Societies Library. The books were selected from those added to the Library during 1946. Some equally good books may have been omitted but the necessity for a short list has forced a choice among the large number of books received.

Building Construction Estimating, G. H. Cooper. 282 pp. 1945, McGraw-Hill Book Co., N. Y. $3. Discusses contracting as a business, building codes, plans, specifications, contracts, and the technique of estimating.

Theory and Practice of Filtration. G. D. Dickey and C. L. Bryden. 346 pp. 1936, Reinhold Publishing Corp., N. Y. $6. Deals with the separation of solids from liquids and gases by the use of porous media; mostly devoted to liquid filtration.

Airport Planning, C. Froesch and W. Prokosch. 250 pp. 1946, John Wiley & Sons, N. Y. $7. Indicates proper relationship of landing facilities to the communities they serve; analyzes characteristics of aircraft which affect planning and design of these facilities. Practical and detailed consideration is given to airfield construction and lighting, building design, hangar design, and special services.

Airports: Design, Construction and Management, H. K. Glidden and others. 583 pp. 1946, McGraw-Hill Book Co., N.Y. $7. Comprehensive work covers factors in site selection, runway layout, construction, equipment, principles of management. A 300-page appendix contains full and exact specifications and test procedures for materials and construction methods.

Water Supply Purification, W. A. Hardenburgh. Second edition, 488 pp. 1945, International Textbook Co., Scranton, Pa. $4. The theories underlying the collection, transportation, delivery and treatment of water are presented, including the determination of quantity of water available, pipeline calculations, design of distribution systems, and purification processes.

Beams on Elastic Foundation, M. Hetényi. 255 pp. 1946, University of Michigan Press, Ann Arbor, Mich. $4.50. Deals with analysis of elastically supported beams. Chiefly theoretical in nature, the book also discusses applications to a variety of problems in civil and mechanical engineering.

Sheet piling, Cofferdams, and Caissons, D. H. Lee. 191 pp. 1945, Concrete Publications Ltd., London, 10*s*. Covers sheet piling and earth pressures in deep foundation work, design and construction of cofferdams, and the theory and practical application of cylinders and both open and pneumatic caissons.

Engineer at Law; a Resumé of Modern Engineering Jurisprudence, C. B. McCullough and J. R. McCullough. 2 Vols. vol. 1, 447 pp., vol. 2, 442 pp. 1946, Collegiate Press, Inc., Ames, Iowa. $6 for 2 vols. Provides the engineer with a source of information that will help him to avoid legal pitfalls and to deal more efficiently with the legal problems that may arise.

Personality and English in Technical Personnel, P. B. McDonald. 424 pp. 1946, Van Nostrand Co., N.Y. $3.75. Emphasizes the importance of developing a definite personality, an accurate command of English, and effective methods for presenting ideas, both written and verbal, and gives suggestions for improvement.

Statically Indeterminate Structures, L. C. Maugh. 338 pp. 1946, John Wiley & Sons, N. Y. $5. Classifies and describes statically indeterminate structures, explains and illustrates methods of analysis, emphasizing methods of successive approximation.

Engineer in Society, J. Mills. 196 pp. 1946, Van Nostrand Co., N. Y. $2.50. A group of essays, dealing with the relationship of scientists and engineers to the world society in which they function.

Design of Reinforced Concrete Structures, D. Peabody. Second edition, 532 pp. 1946, John Wiley & Sons, N. Y. $5.50. New material on "plastic theory," prestressed concrete, rigid-frame design, and special conditions of beams and continuous frames.

Materials-Handling Equipment, M. W. Potts. 172 pp. 1946, Pitman Publishing Corp., N. Y. $2.50. Describes and discusses application of standard types of materials-handling equipment.

Elementary Mechanics of Fluids, H. Rouse. 376 pp. 1946, John Wiley & Sons, N. Y. $4. The author considers the mechanics of fluids to be as fundamental to a treatment of fluid behavior as the mechanics of solids is to the behavior of rigid and elastic bodies, and develops flow principles from the basic equations of mechanics in a logical, systematic order.

Water Treatment and Purification, W. J. Ryan. 270 pp. 1946, McGraw-Hill Book Co., N. Y. $2.75. Discusses the construction and operation of the different types of filtering, softening and treating apparatus.

Data Book for Civil Engineers, E. E. Seelye. 3 Vols. John Wiley & Sons, N. Y.

Vol. 1. Design. 417 pp. 1945. $7.50. A comprehensive collection of effective design data in each main field of civil engineering.

Vol. 2. Specifications and Costs. 325 pp. 1946. $6.75. Presents typical specifications to serve as a guide for the practicing engineer; section on costs provides a framework of relative costs of materials, equipment and labor; has 70-page, classified glossary.

Vol. 3. To be published in May 1947. Will cover field practice.

Mathematical Theory of Elasticity, I. S. Sokolnikoff. 373 pp. 1946, McGraw-Hill Book Co., N. Y., $4.50. The first three chapters contain a comprehensive treatment of the underlying theory of the mechanics of deformable media. Chapter IV gives an up-to-date treatment of extension, torsion and flexure of homogeneous beams. Chapter V develops variational methods necessary for the treatment of problems of elasticity.

Photography in Engineering, C. H. S. Tupholme. 276 pp. 1945, Faber & Faber, Ltd., 24 Russell Sq., London W.C.1. 42*s*. Discusses ways in which the camera is being used to simplify the draftsman's work, to analyze raw materials, to make records of high-speed machinery, to study molecular structure of metals, etc.

Legal Phases of Construction Contracts, I. V. Werkin. 265 pp. 1946, McGraw-Hill Book Co., Inc., N. Y. $2.75. Discusses 46 different legal problems that have arisen in connection with construction contracts, of practical interest to engineers, architects, contractors and attorneys.

NEW IN Education

State Department Promotes Study in South America

TRAVEL AND MAINTENANCE GRANTS are being made by the Department of State to assist United States graduate students to undertake academic studies or research in the other American republics. The department has the cooperation of the U.S. Office of Education and the Institute of International Education in this program.

The grants are made to supplement personal funds of the recipients, or funds they may receive through fellowships or other assistance from universities, research councils, etc. The grants provide travel or maintenance or both, in accordance with the student's individual needs and estimates of living costs in the countries where he is to study.

Projects are considered with reference to their usefulness in the development of broader understanding between the United States and the other American republics, as well as on the basis of their technical merit, and are sponsored by appropriate university or college authorities.

Grants are issued for a minimum period of six months and a maximum of one year, with the possibility of renewal provided funds are available. In charge of the grants is the American Republics Section, Division of International Educational Relations, U.S. Office of Education, Federal Security Agency, Washington 25, D.C.

Students Need Training in Safety, Says ASME Speaker

"THE TIME TO IMPART a knowledge of accident prevention is during the engineer's formative years in school, for as the engineer is trained so will he think when he takes his place in industry." This statement by John V. Grimaldi research engineer, was made before the 67th annual conference of the American Society of Mechanical Engineers. "In fact," he continued, "a knowledge of accident prevention is as important to the engineer as are his basic sciences and mathematics."

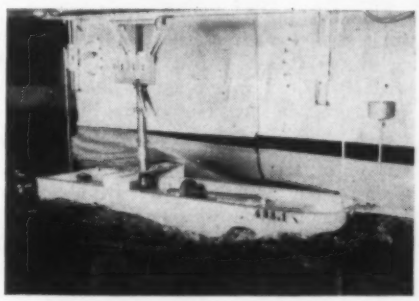
To refute the contention that safety impedes production, Mr. Grimaldi cited the results of a study recently made by the Center for Safety Education at New York University. In this study 100 industrial workers with certain physical impairments were compared with 100-able-bodied workers and the efficiency of both groups measured. It was found that the disabled exceeded the normal men in production on comparable work and earned more—$51.21 a week as against $49.22. The accident frequency rate for the disabled was also better than for the normals—that is, the group having the better accident frequency rate also had the better production record.

Despite some "hard-shelled resistance," it is becoming generally recognized that some training in safety should be included in the engineering course, Mr. Grimaldi said. "At present it is believed that the training should be offered by integrating the fundamentals of safety in certain specific engineering courses, and work has even been undertaken to prepare syllabi for aiding instructors in those courses." Associating the course subject matter with something of momentous significance to the student—his safety and that of others—would provide motivation for learning, he affirmed.

"Towing Tank" Reports on Expanded Research Program

"MAN HAS BEEN building and sailing ships for thousands of years, but there are today many hydrodynamic problems concerning which there is little knowledge." This statement is from a report published by the Experimental Towing Tank Laboratory of Stevens Institute of Technology, which recounts the Tank's development in 10 years from a staff of two men testing sailing-vessel models in the college swimming pool, to a staff of 60 carrying on long-range research on Army, Navy, and civilian craft in three of the most modern towing tanks in the country.

The aftermath of the war has left many unfinished problems—such as studies on



EXPERIMENTAL TOWING TANK Laboratory at Stevens Institute of Technology tests model of Army amphibian the *Weasel*.

turning and steering of ships—and the possible advent of atomic-powered ships means overhauling the whole matter of resistance and hull form, the report states. There is also need for the correlation and completion of data on seaplane hulls. With the increase in size and speed of aircraft, some of the disadvantages of seaplanes as compared with land planes disappear, and water offers an indestructible and inexpensive landing field available in most parts of the world. New projects now in progress at the Tank include investigations for the Navy of the dynamic characteristics of submarines and torpedoes while submerged.

Looking toward a period of intensive research during the next ten years, the Tank has set up fellowships for graduates of engineering and scientific schools. Two have already been granted and three more are still open.

Plans are being made for a broad course in hydrodynamics, unique in this country, as a joint undertaking of several institutions in the New York area. Recognizing the lack of coordination among the various hydrodynamic laboratories in this country, the Tank proposes that a group of technical leaders in the various phases of hydrodynamics be formed as an integral part of federal programs now under consideration.

$60,000 Is Granted for Lehigh Bomb Damage Analysis

BOMB DAMAGE REPORTS AND STUDIES made in World War II will be subjected to engineering analysis by Lehigh University under a grant of $60,000 from the War Department. Director of the research project will be Cyril D. Jensen, Assoc. M. ASCE, professor of civil engineering at Lehigh, who will be assisted by three other Lehigh faculty members: Dr. George D. Harmon, head of the history department; Merton O. Fuller, M. ASCE, associate professor of civil engineering; and Dr. Glenn J. Christensen, associate professor of English. Lehigh alumni are also engaged in this study, including Frank O. Dufour, M. ASCE, former senior engineer of the Inspection Division, PWA; and Herbert T. Rights, Assoc. M. ASCE, former bridge engineer of the Lehigh Valley Railroad.

INCO Enlarges Cooperative Educational Program

TO BROADEN its cooperation with universities and colleges, the International Nickel Co., through its Development and Research Division, will furnish to each such institution an exhibit containing about 50 specimens of nickel-containing materials; a portable metals identification kit containing about 35 specimens of important metals and alloys for qualitative identification of metals and alloys (spot-testing); literature and other technical and practical information. Motion pictures of the company's mining, smelting and refining operations will also be made available.

The new program has been offered to, and accepted by, a number of institutions in the United States and Canada. As rapidly as possible it will be offered to all engineering schools.

Industrial Safety Course Offered by Correspondence

FOR THE SPECIAL benefit of supervisors and others concerned with safety rules in industry, the extension division of the University of Wisconsin is offering a new correspondence course, "Industrial Safety Engineering." The course is similar to one given in the wartime program of Engineering, Science, and Management War Training. Details may be secured by addressing the University Extension Division at Madison, Wis.

Scholarship Fund Started by Canadian Engineers

AN EDUCATIONAL FUND to help university students to become engineers or scientists has been started by the Engineering Institute of Canada. For some months a campaign has been carried on among the Institute membership to raise $25,000 for this purpose. Although the campaign is still in progress, the first loan has been made to a deserving student.

The fund is known as the "Harry F. Bennett Educational Fund" in memory of the late Harry F. Bennett, who accomplished much in carrying the Institute's influence and assistance to high school and engineering students.

Illinois Institute of Technology Once More Offers Fellowships

TO FURTHER STIMULATE graduate study in science and engineering, Illinois Institute of Technology is again offering fellowships, scholarships, and assistantships for the term beginning September 22, 1947. Among the fellowships which permit advanced study leading to either a master of science or a doctor of philosophy degree are: Illinois Institute of Technology Research Fellowships; Universal Oil Products Fellowship in Chemistry; Westinghouse Educational Foundation Fellowship in Power Systems Engineering; Institute of Gas Technology Fellowships in cooperation with the affiliated Institute of Gas Technology; and the Armour Research Foundation Industrial Research Fellowships. Although the fellowships carry different stipulations and stipends, the basic requirement for all is a bachelor of science degree from an accredited college.

Wood Construction Unit Is Established at VPI

A DEPARTMENT OF WOOD construction has been established in the School of Engineering of the Virginia Polytechnic Institute with Dr. E. George Stern, Assoc. M. ASCE, as head. Dr. Stern is also director of the VPI Wood Research Laboratory. The new department will offer five courses open to graduate students and seniors, and the degree of Master of Science in Wood Construction will be given. These courses are offered as a result of requests by students and by the wood-using industry of Virginia and adjacent states. The five courses to be given are: Wood, Plywood, and Plastics; Timber Engineering; Advanced Timber Engineering; Wood, Plywood, and Plastic Research; and Timber Engineering Research.

VPI has been active in the field of wood construction since 1941, when its Wood Research Laboratory was established. Its most recent publication embodying research results is VPI Engineering Extension Division Bulletin No. 45, "Modern Timber Construction in Europe" (24 pages, 38 illustrations), which can be obtained from the department of Wood Construction, Virginia Polytechnic Institute, Blacksburg, Va.

NEWS OF Engineers

Lansing G. Simmons has been appointed to the position of chief mathematician, Division of Geodesy, U.S. Coast and Geodetic Survey, succeeding the late **Henry G. Avers.** Mr. Simmons has been connected with the Coast and Geodetic Survey for a number of years, and has been principal geodetic engineer since 1931.

Quinto Vallei has opened an engineering office in Philadelphia, where he will specialize in the design of concrete, steel, and timber structures, and estimating. Mr. Vallei was formerly stress engineer for the Navy Department of Public Works at Yorktown, Pa.

Karl Imhoff, until lately in private practice at Schondorf, Bavaria, has returned to practice in Essen, Germany, where for many years prior to the war he was engaged in water supply and sewage treatment work and in developing his sewage settling and reduction tank.

Allen Janssen, dean of the engineering school at the University of Idaho, has been appointed to the Idaho State Board of Engineering Examiners for a term ending in May 1953.

Albert B. Jones, colonel, Army Corps of Engineers, has retired after 28 years of service in the Corps. Most recently Colonel Jones has been in charge of the District Engineer's office at Jacksonville, Fla.

Wilbur S. Smith, associate director of the Bureau of Highway Traffic at Yale University, and **Wortham W. Dibble** have opened an engineering office at Columbia, S.C., for the study of traffic problems. Mr. Dibble was recently released from the Army Corps of Engineers, with the rank of major.

Gordon R. Williams is now on the engineering staff of the Knappen Engineering Co., New York City. For the past several years, Mr. Williams has been in the Corps of Engineers, most recently in the capacity of head of the flood-control division of the New England Division.

Willis C. Christopher has been transferred from the Boise, Idaho, office of the U.S. Bureau of Reclamation, to Ephrata, Wash., where he will be assistant supervising engineer for the irrigation division of the Bureau on the Columbia Basin project.

Frank W. Barnes has been promoted from the position of construction manager for the Merritt-Chapman & Scott Corp., New York City, to that of assistant to the president. Mr. Barnes has been connected with the organization since 1937.

G. Douglas Andrews has been appointed to the post of chief engineer of the Baltimore metropolitan district. Until lately he was acting head of the Baltimore County Highway Department.

Ben Moreell has been elected president of the Jones & Laughlin Steel Corp., Pittsburgh, chairman of the board of directors, and chairman of the executive committee of the organization. He will begin his duties with Jones & Laughlin on March 17, but will continue as president of the Turner Construction Co., of New York City, until June 1, and thereafter as a director of the company. Admiral Moreell, former Federal Coal Mines Administrator, retired from the Navy in September 1946 after 30 years in the Civil Engineer Corps.

Ben Moreell

Rolf T. Retz, after eleven years of government service, is now associated with the Virginia Engineering Co., Inc., general contractors of Newport News, Va. His most recent assignment has been as specifications engineer for the National Advisory Committee for Aeronautics at Langley Field, Va.

Thomas R. Camp, consulting engineer of Boston, has formed a partnership with his associates—**Herman G. Dresser** and **Jack E. McKee**—and will continue his consulting practice under the firm name of Camp, Dresser & McKee, with offices at 6 Beacon Street, Boston. The firm will specialize in water and sewage works and the treatment and disposal of municipal and industrial wastes.

Frederick S. Gibbs is now president of the Engineering Sales Corp., New England representative of the Liquid Conditioning Corp., of Linden, N.J. Mr. Gibbs' headquarters will be in Boston. He was formerly New England district manager of the Wallace & Tiernan Co., Inc.

John O. Eichler, previously assistant Professor of civil engineering at Syracuse University, has been appointed to a similar position at the Cooper Union School of Engineering in New York. He will be in charge of surveying courses, including those given at the School's Green Engineering Camp in New Jersey.

Hamilton G. Grady, who has had a structural engineering practice since his separation from the Navy, has formed a partnership with **Leslie G. Jost,** until lately a structural engineer with Quinton Engineers, Ltd., of Los Angeles. As Grady & Jost, they have opened an office in Los Angeles, and will specialize in the design of industrial and commercial structures.

John C. Bumstead has severed his engineering connection with William Olsen, consulting engineer of Raleigh, N.C., to become assistant editor of *Engineering News-Record*. During the war, Mr. Bumstead was a lieutenant colonel in the Army Sanitary Corps.

M. C. Patton has been named vice-president of Armco Drainage and Metal Products, Inc., Middletown, Ohio. On the Armco staff since 1926, Mr. Patton has been assistant general manager and a member of

the board of directors since 1945. In addition to his duties as vice-president, he will continue as assistant general manager.

Edward W. Chadeayne has been appointed division engineer for the Ohio State Highway Department, with headquarters at Garfield Heights. His territory includes Cuyahoga, Lake, and Geauga counties.

George W. Carr and **Clark C. Wright** have formed the Chicago architectural-engineering firm of Carr and Wright, successor to Nimmons, Carr & Wright.

Jamison Vawter, professor of civil engineering at the University of Illinois, was elected treasurer of Theta Tau, national engineering fraternity, at the 16th biennial convention of the organization. Another ASCE member—**Donald D. Curtis,** head of the mechanics department at Clemson College—has been elected to the executive council.

A. C. Eberhart, captain, Navy Civil Engineer Corps, will replace Commodore **A. D. Hunter** as public works officer, Commander Naval Forces, Philippines.

Robert L. Pearson, vice-president of the New York, New Haven & Hartford Railroad Co., was recently elected to the board of the American Standards Association for a three-year term.

AT WINTER MEETING OF American Institute of Electrical Engineers Dr. Lewis W. Chubb, director of Westinghouse Research Laboratories, East Pittsburgh, Pa., receives John Fritz Medal. Left to right: M. W. Smith, vice-president of Westinghouse Electric Corp.; Dr. Chubb; N. E. Funk, of Philadelphia, chairman of Board of Award; and Malcolm Pirnie, Past-President ASCE, presiding.

Cameron Smith, Leslie Clayton, and **Claude Klemme, Jr.,** recently joined the civil engineering and architectural staff of the University of Colorado. During the past year, all three were released from the Navy Civil Engineer Corps, in which they served as officers.

The Burns & McDonnell Engineering Co., of Kansas City, Mo., has enlarged its firm membership from the present four members—**R. E. McDonnell,** M. ASCE, **Chester A. Smith,** M. ASCE, **R. L. Baldwin,** and **R. H. McDonnell**—to eight. The four new members, selected from the senior associate engineers, are: **Arthur F. Hartung,** electrical engineer; **Russell G. Kincaid,** M. ASCE, who has been with the firm for 20 years and specializes in hydraulic work; C. Kelsey **Mathews,** M. ASCE, who has been on the staff for 24 years and is a specialist in appraisals and sanitary work; and **Earl J. Thomson,** electrical engineer.

Now in its 49th year, the firm has rendered engineering service on over 2,000 projects throughout the United States, Mexico, and Canada. It specializes in water works, sewerage, lighting, power, and appraisal work. Beginning January 1, 1946, the firm adopted a policy of profit sharing with its 75 employees, on a basis of salary and seniority.

BURNS & McDONNELL ENGINEERING CO., KANSAS CITY, MO., has added four new members to firm. Present membership of firm (left to right, front row) consists of R. E. McDonnell and Chester A. Smith, Members ASCE; (back row) C. Kelsey Mathews, M. ASCE, E. J. Thomson, R. H. McDonnell, A. F. Hartung, Russell G. Kincaid, M. ASCE, and R. L. Baldwin.

William E. Blaser has been appointed chief deputy county engineer for Cleveland County, Ohio, with headquarters in Cleveland.

Guy M. Fairchild has resigned as project engineer for the Federal Works Agency to take a position as engineer-examiner for the Illinois Postwar Planning Commission, with headquarters in Springfield.

Wardner G. Scott has been reappointed to another term as Nebraska state engineer, a post he has held since 1942.

W. D. Hatfield, superintendent of the Decatur, Ill., Sanitary District, has been made chairman of the Decatur City Planning Commission.

Edward Stickney is being transferred from the Utica office of the New York State Department of Public Works, where he was assistant district engineer, to the Albany office of the Department. Mr. Stickney will be assistant district engineer at Albany, a post that he filled before his transfer to Utica.

Karl A. Sinclair has been appointed chief engineer of the City and County of Honolulu, T. H. Mr. Sinclair has been in Hawaii for some years—from 1940 until now as airport engineer with the territorial public works department.

Margaret Woolverton, formerly a traffic engineer on the staff of the Traffic and Transportation Division of the National Safety Council, Chicago, has become associated with Quinton Engineers, Ltd., of Los Angeles, in a similar capacity.

Harvey J. Kulin, who was recently released from the Army Sanitary Corps, is now an associate in the consulting firm of Couch & Kulin, with headquarters in Indianapolis, Ind.

Raymond V. Miller is retiring from the Navy Civil Engineer Corps, with the rank of captain, after more than 30 years of service in the Corps.

Morton O. Withey, dean of the college of engineering at the University of Wisconsin, has been awarded the Henry C. Turner Medal of the American Concrete Institute, which is given annually "for notable

achievement in, or service to, the field of concrete." Others honored by the Institute are **J. W. Kelly** and **B. D. Keatts,** who have been awarded the second Construction Practice Award, founded in 1944, "for a paper of outstanding merit on concrete construction practice." The former is associate professor of civil engineering at the University of California, and Mr. Keatts is on the engineering staff of Intrusion-Prepackt, Inc.

Ralph H. Burke, previously chief engineer for the Chicago Park District, has established consulting offices in Chicago.

Charles W. Zwally, until lately with the Army Engineer Corps on maintenance of airports in Puerto Rico, has become connected with Gannett Fleming Corddry & Carpentry, Inc., of New York and Harrisburg, Pa. He will be in the Greensburg, Pa., office of the organization on special design work.

Verne Gongwer has resigned as chief engineer in charge of construction for Tacoma City Light to establish a consulting engineering practice in Tacoma. Mr. Gongwer has been with Tacoma City Light for a number of years—most recently on the construction of the Second Nisqually Power Development for the city. Other changes on the staff of the Tacoma City Light include the resignation of **George A. Gregory** from the post of supervising construction engineer for the Second Nisqually Power Development. Mr. Greogry will go to China as principal construction engineer for the national hydroelectric bureau of the National Resources Commission of China.

John H. Bliss, formerly engineer for the Interstate Streams Commission, will succeed the late **Thomas M. McClure** as New Mexico State Engineer. Mr. Bliss was assistant state engineer, prior to joining the staff of the Interstate Streams Commission.

Deceased

Edward Anderberg (M. '22) engineer for the inspection group, Bureau of the Budget, Washington, D.C., died on January 18. He was 65. From 1905 to 1915 Mr. Anderberg was assistant engineer on the construction of the New York State Barge Canal; from 1915 to 1925, senior engineer in charge of the construction of New York City terminals for the Barge Canal; and from 1925 to 1933, division engineer for the Westchester County Park Commission. During the war, he served with the War Projects Unit of the Bureau of the Budget, examining procedures in connection with the construction and operation of government-owned war facilities. Since the war he had been preparing technical reports for the Bureau of the Budget on military and civil works projects of the Army Corps of Engineers.

Henry Godfrey Avers (Assoc. M. '28) chief mathematician, Division of Geodesy, U.S. Coast and Geodetic Survey, Washington, D.C., died on January 19. Mr. Avers, who was 60, had been with the Coast and Geodetic Survey since 1908, and had been chief mathematician since 1924. He was the author of a number of works on precise leveling, triangulation, and other surveying subjects.

William Henry Brady (Assoc. M. '45) engineering lecturer at the University of California and member of the architectural and civil engineering firm, Young & Brady, Albany, Calif., died suddenly at his home at Danville, Calif., on December 31. He was 31, and an alumnus of the University of California, holding the degrees of B.S. and M.S. in C.E. He had been with the Standard Oil Co. of California, and during the war served for a time as lieutenant in the Army Corps of Engineers.

Richard Eugene Danforth (M. '06) consultant to the Public Service Coordinated Transport, Newark, N.J., died on June 3, 1945, according to word just received at Society headquarters. Mr. Danforth, who was 80, had been consultant to the Public Service Coordinated Transport since 1924. Earlier in his career he had been manager and vice-president of the Rochester, N.Y., Railway Co. and vice-president and general manager of the Public Service Railway of New Jersey.

Frank Terence Davis (M. '45) principal engineer for the Reconstruction Finance Corp., Washington, D.C., died there suddenly on January 7. Mr. Davis, who was 48, had spent much of his professional life in South America and Cuba, where he built a number of sugar plants and lighthouses for the Cuban government. Returning to the United States in 1937, he became chief engineer for the Cumberland Homesteads at Crossville, Tenn. Since 1942 he had been with the Reconstruction Finance Corp.—as senior engineer in charge of aluminum plant development at Sheffield, Ala., and division engineer for the Pittsburgh area. In 1945 he was transferred to Washington as principal engineer to handle the surplus property section in the office of the Assistant Chief Engineer.

Samuel Edwards Fairchild, Jr. (M. '08) chairman of the board of the Cruse-Kemper Co., makers of steel tanks at Ambler, Pa., died in a Philadelphia hospital on December 31. Mr. Fairchild, who was 74, was for a number of years president of the Cruse-Kemper Co., and he had been chairman of the board since 1929. Earlier in his career he was a member of the Philadelphia engineering firm, Fairchild & Gilchrist.

Arthur Grant Holt (M. '10) retired engineer of Evanston, Ill., died on June 28, 1946, according to word just received by the Society. Mr. Holt, who was 81, had spent his entire career with the Chicago, Milwaukee, St. Paul & Pacific Railroad, having joined the organization as assistant engineer in 1890. He was assistant chief engineer from 1913 to 1932, and assistant to the chief engineer from the latter year until his retirement in 1938.

Henry Hobart Porter (M. '03), utility executive and chairman of the board of the American Water Works and Electric Co., New York City, died at his home there on February 9, at the age of 81. In his early career, Mr. Porter was with several mining companies in Mexico and the Southwest, and the Westinghouse Electric and Manufacturing Co. in Pittsburgh. In 1896, with the late E. N. Sanderson, he formed the New York firm of Sanderson & Porter, which was one of the earliest designers and constructors of oil pipe lines and made the first survey of the feasibility of transporting gasoline long distances by pipe lines. He retired from active participation in the firm in 1941. From 1914 to 1937 he was also president of the American Water Works & Electric Co., and since the latter year had been chairman of the board. Mr. Porter had also been a member of the executive committee of the National Research Council, and for several years was chairman of the Engineering Foundation.

Martin Harris
Henry H. Porter

Alexander Sylvester Forster (Assoc. M. '16) senior partner in the Toledo (Ohio) engineering firm of Forster, Wernert & Taylor, died at his home in that city on January 25. He was 67. Mr. Forster began his career in Toledo at the turn of the century as a member of the city engineering office. Later he was an engineer with the American Bridge Co. and the Toledo Bridge & Crane Co. His own company specialized in bridge construction. Mr. Forster was prominent in the Toledo Section, which he had served as president. He was also chairman of the City Council Building Code Committee, and had been president of the Ohio Society of Professional Engineers.

Raoul Charles Gautier (M. '28) supervisor of construction of foreign buildings for the Department of State, died in Washington, D.C., on January 20. He was 59. Born and educated in France, Mr. Gautier was first employed by the Hennebique Co., which he represented in England and Canada. In 1914 he came to the United States, where he became connected with the Truscon Steel Co. and Thompson & Binger, of New York. Later, as a member of the New York firm of Dambach & Gautier, he constructed many of the government buildings in Nicaragua and engaged in the rehabilitation of Brazilian railroads. For the past two years Mr. Gautier had been traveling in South America and Africa in connection with his work for the State Department.

Harry Clifford Innes (Assoc. M. '07) retired engineer of Cincinnati, Ohio, died on February 11, 1945, according to word just received by the Society. He was 80. Mr. Innes' early experience included railroad work, a period as U.S. assistant engi-

neer on river and harbor surveys at Cincinnati, and some years as superintendent of the Warren Scharf Asphalt Paving Co. For many years he maintained a consulting practice in Cincinnati, retiring in 1935.

Carlos **Lobo** (M. '16) retired engineer of Newton, N.J., died recently at the age of 73. From 1894 to 1919 Mr. Lobo was with the New York City Department of Water Supply—for some years as borough engineer in charge of the Brooklyn water-supply system. From 1919 until his retirement in 1936 he was vice-president and director of the Kelvin Engineering Co., a New York consulting and contracting organization.

William **Naylor McDonald** (M. '02) retired engineer of Jacksonville, Fla., died in a hospital there on January 6, at the age of 77. Mr. McDonald had had a contracting practice in Nashville, Tenn., and Savannah, Ga., and at one time was with the Southern Construction Co., of Jacksonville. More recently he was city manager of St. Augustine, Fla., and until his retirement a few years ago maintained a civil engineering and construction practice in Jacksonville. Mr. McDonald was a veteran of both the Spanish-American War and World War I.

Elmer **Gove Manahan** (M. '09) of Mount Vernon, N.Y., died suddenly at his home there on December 30, at the age of 76. Mr. Manahan had been division engineer for the New York Board of Water Supply and resident engineer for the Wilmington, Del., Board of Water Commissioners. For a number of years he was connected with the New York consulting firm of Fuller & McClintock, retiring in 1936.

Rudolph Philip Miller (M. '04) consulting engineer of New York City, died at his home in White Plains, N.Y., on January 18. Mr. Miller, who was 80, had been in private practice since 1922. Earlier in his career he was with the Southern Railway at Richmond, Va., and in the New York City Building Department. He had also been superintendent of buildings for New York City, and for a time was retained by the New York Board of Aldermen to revise the building laws. Mr. Miller had served as editor of several engineers' and architects' handbooks.

Raymond George Paustian (Assoc. M. '38) associate professor of civil engineering at Iowa State College, Ames, Iowa, died on September 4, 1946. Professor Paustian, who was 41, had been on the engineering staff at Iowa State College since 1930. He had also been highway engineer for the Iowa Engineering Experiment Station, and was the author of numerous articles on highway and other technical subjects.

Reinaldo Ramirez (M. '33) chief engineer of the American Railroad Co. of Puerto Rico, died on January 19. His age was 55. Mr. Ramirez was educated at Cornell University, returning to Puerto Rico in 1916 and entering the employ of the South Puerto Rico Sugar Co. From 1921 to 1926 he was with the Isabela Irrigation Service, and since the latter date he had been with the American Railroad Co. Long active in the Puerto Rico Section, Mr. Ramirez was secretary for many years and had served a term as president. He was also chairman of the local committee on membership qualification.

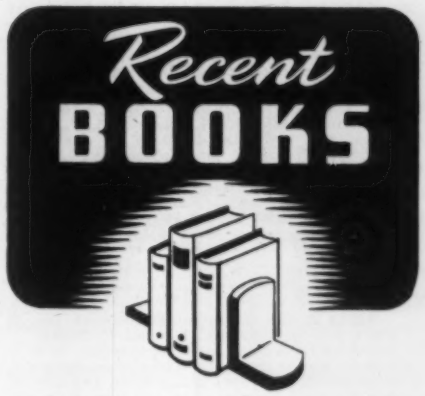
Allen Jeter Saville (M. '21) consulting engineer of Richmond, Va., died there on January 20, at the age of 58. Early in his career (1908 to 1917) Mr. Saville was assistant city engineer of Richmond in charge of sewers, and later was director of the Richmond Department of Public Works. During his tenure as director of public works, he designed the Shockoe flood-control project for the protection of downtown Richmond, and drew up a zoning ordinance for the city. In 1924 he organized the company, Allen J. Saville, Inc. During the recent war, his firm built housing and warehouse facilities for the Navy at Portsmouth and was in charge of construction at Fort Belvoir and of the expansion of Langley Field. Long active in the Society and Virginia Section, Mr. Saville was serving as Section Contact Member at the University of Virginia at the time of his death.

Felix Charles Stehle (Assoc. M. '03) of Towanda, Pa., died on August 14, 1946, according to word just received by the Society. He was 74. Early in his career Mr. Stehle was with the Cornell Iron Works and the Union Bridge Co., which was later consolidated with the American Bridge Co. From 1913 until his retirement in 1941, he was bridge inspector for the Lehigh Valley Railroad Co., with headquarters in Bethlehem, Pa. During this period he also directed all field work in connection with the reconstruction of the company's main-line bridges.

Paul Sterling (M. '19) assistant to the chief engineer, New York, New Haven & Hartford Railroad, New Haven, Conn., died on January 1. Mr. Sterling, who was 76, had spent his entire career in the engineering department of the New York, New Haven & Hartford Railroad, having gone there in 1893.

James Eaton Torrey (M. '20) retired civil engineer of Paterson, N.J., died at his home there on January 20, at the age of 70. A veteran of the Spanish-American War, Mr. Torrey was at one time with the Central Railroad of New Jersey. Later he was for a number of years chief engineer for the John W. Ferguson Co., a New York and Paterson building construction firm, and in 1935 he became vice-president and chief engineer of the Samworth-Hughes Co., of Paterson. He retired in 1942.

Henry Arthur Van Alstyne (M. '07) retired engineer of New York, died at his home there on January 23, at the age of 77. Mr. Van Alstyne spent his early career on the construction of sewers, highways, locks, and dams for New York State, and from 1904 to 1907 was state engineer. He then became an engineer for the Atlantic, Gulf & Pacific Co., and later served in the same capacity with the Acme Engineering Co. and as president of the Sterling Iron & Railroad Co. of New York. From 1919 to 1933 he was president of the New York State Dredging Corp., and from the latter year until his retirement in 1938 maintained a consulting practice in New York.



A.S.T.M. Specifications for Steel Piping Materials. Prepared by A.S.T.M. Committee A-1 on Steel: Pipe, Tubes, Castings, Forgings, Bolting. American Society for Testing Materials, Philadelphia, 1946. 296 pp., illus., diagrs., tables, 9 × 6 in., paper, $3 (A.S.T.M. members, $2.25). This compilation contains all the specifications for carbon-steel and alloy-steel pipe and tubing, issued by the Committee on Steel, and four jointly sponsored stainless steel tubing specifications. These specifications cover: (1) pipe used to convey liquids, vapors, and gases at normal and elevated temperatures, (2) still tubes for refinery service, (3) heat-exchanger and condenser tubes, and (4) boiler and superheater tubes.

Advanced Mechanics of Materials. By G. Murphy. McGraw-Hill Book Co., New York and London, 1946. 307 pp., illus., diagrs., charts, tables, 9¼ × 6 in., cloth, $4. This book is designed to guide the student in a critical analysis of his previous knowledge in the field, to extend his information along these lines, and to teach him to apply his knowledge effectively. Topics covered include the relationships among stresses and strains at a point, theories of failure, axial loading, thick-walled cylinders, torsion, unsymmetrical bending, shear center, buckling, and stresses near concentrated loads. Emphasis is placed upon the fundamental tools—statics, geometry, and properties of the materials—and upon the way these tools are applied.

Manual of Design for Arc Welded Steel Structures. Compiled by L. Grover. Air Reduction Sales Co., New York, March 1946. 281 pp., illus., diagrs., charts, tables, 9¼ × 6 in., fabrikoid, $2. The material in this manual is divided broadly into three sections. The first section covers fundamentals of design, typical details, data and diagrams for design calculations, estimation of cost, and inspection methods. The second presents standardized welded connections for simple framing and tables of allowable loads on beams and piece marks for welded connections. The third contains welding terms, definitions and symbols, acceptable and unacceptable weld profiles and joints, and condensed information on electrodes for structural welding.

New Riches from the Soil, the Progress of Chemurgy. By W. McMillen. D. Van Nostrand Co., New York, 1946. 397 pp., 8½ × 5½ in., cloth, $3. The importance of chemurgy, the industrial utilization of agricultural raw materials, is shown to result from the self-renewing abilities of the materials as compared, for example, with the exhaustible supplies of mineral raw materials. The book describes the present products from plant sources and the new ones in prospect, discusses the search for new crops to fill certain wants, and shows how agricultural waste products are utilized. Government activities and the work of the Chemurgic Council are described. The first three chapters present the historical background of the new field of achievement.

Petroleum Production Engineering, Oil Field Development, 3 ed. By L. C. Uren. McGraw-Hill Book Co., New York and London, 1946. 764 pp., illus., diagrs., charts, tables, 9 × 5¾ in., cloth, $7. This standard text covers every phase of petroleum production engineering up to the point at which the wells are ready to produce. It sketches briefly the problems of petroleum exploration, discusses the principles and practices of oil-field development, and describes the methods and equipment used in modern well drilling. Special chapters are devoted to oil-field hydrology, fishing tools and methods, well completion, well records and surveys. A selected bibliography accompanies each chapter, and a list of illustrative motion picture films is given.

Surface Construction without Accidents. Published by American Mutual Liability Insurance Company, Engineering Department, Boston (142 Berkeley St.), 1946. 81 pp., illus., tables, 7½ × 5 in., fabrikoid, apply. The term, "surface construction," includes streets, runways, parking areas, airports, and similar projects, where earth-moving, paving, and related opera-

tions are principally involved. The major part of the book is devoted to specific safety instructions for the various types of jobs included in such work. Separate chapters deal with the protection of the general public, first aid, and payroll and cost records.

WOMEN CAN BE ENGINEERS. By A. C. Goff. Youngstown, Ohio (153 Lauderdale Ave.), 1946. 227 pp., $8^3/_4 \times 5^1/_2$ in., cloth, $2.50. In Part I the author presents biographical sketches of thirteen women who have achieved success in the engineering field, with emphasis, on their work. Part II presents similar information about six more women, who have done effective work in allied technical and scientific fields.

Books in the Engineering Societies Library may be borrowed by mail by ASCE members for a small handling charge. The Library also prepares bibliographies, maintains search and photostat services, and can provide microfilm copies of any item in its collection. Address inquiries to Ralph H. Phelps, Director, Engineering Societies Library, 29 West 39th Street, New York 18, N.Y.

Snoqualmie Tunnel Plan Provides Low-Level Route

(*Continued from page 27*)

Because of the high cost of the tunnel, the construction of the companion tube should, for financial reasons, be deferred until the first tube is on a sound financial basis and the volume of traffic indicates the necessity for traffic relief. The four-lane connecting highway on the mountain crossing, which should be built at the time of the opening of the first tube, is necessary from the start because of conditions beyond the tunnel portals, but its full capacity will not be realized until the building of the second tube.

With the completion of the second tube at Snoqualmie, that is, with a two-lane tunnel for east-bound traffic and a similar two-lane tunnel for west-bound traffic, this highway could handle a volume of mixed traffic in excess of twelve million vehicles per year.

Future Highway Needs

Looking into the future, when additional highway capacity across the Cascade Mountains will be necessary, the next step would be the building of a highway along the Green River Valley with initially a single two-lane tunnel at Stampede and eventually a second two-lane companion tunnel. The highway from the east portal of that tunnel would follow the Yakima River Valley to Easton and Cle Elum, paralleling the Snoqualmie route. These two four-lane highways, with four-lane tunnels on each route, should without difficulty handle twenty-five million vehicles of mixed traffic per year; and this is anticipating the future needs of the state as far as seems necessary or appropriate at this time.

Essential parts of the first step, that is, the building of the first two-lane tube at Snoqualmie, are the following:

1. A new highway across the Wenatchee Mountains from a point on the present primary state highway at the point of confluence of Swauk Creek and Iron Creek on the south foothills of the Wenatchee Mountains, over Swauk Pass to a junction with the primary state highway at Cashmere.
2. A new express highway from primary state highway No. 1 in the vicinity of Milton to a connection with primary state highway No. 2, 6 miles east of North Bend, at a point which in this report is referred to as North Bend Junction.
3. Making primary state highway No. 2 four lanes on the mountain crossing between North Bend Junction and Easton, with such rectification of the line and grades of that highway as is necessary to make it a safe, high-speed and economical all-winter route.
4. A low-gradient highway for truck traffic from Georgetown Junction to South Seattle.
5. A low-gradient highway for truck traffic from a point on the highway described under Item 4, east of Renton to an intersection with primary state highway No. 2, east of Lake Washington at Newport.
6. An improved highway from primary state highway No. 2, east of Lake Washington to Everett by way of the vicinity of Kirkland and Bothell.

Tunnel Route Important to National Defense

An all-winter dependable highway across the Cascade Mountains will be of great importance in the national defense. Such a highway would make it easier to defend the strategically important area around Puget Sound, and in case of enemy attack would make it possible to evacuate the large civilian population more quickly than under present means of transportation across the Cascade Mountains.

Maintenance Studies on Hydroelectric Structures

(*Continued from page 37*)

posed chiefly of granite rock which does not usually react with high alkali cement. The expansion noted in these footings did not occur until the concrete was at least 20 years old.

The repair work on the gravity dams and the arched diversion dam was done by Stone & Webster Engineering Corp.; and that on the multiple-arch dam partly by the Stone & Webster Engineering Corp. and partly by the Company's own forces. The repair design and construction supervision was carried out by the Southern California Edison Co.'s staff under the general direction of the writer and W. L. Chadwick, M. ASCE, Manager of Engineering.

This paper was presented before the Power Division at the ASCE Annual Meeting in New York.

Market Value of Engineering Specialties

(*Continued from page 31*)

by the characteristics and possible use of the entire site, and not by those of a portion of it. Cost of storage reservoirs in San Diego County, California, based upon existing reservoirs, is given in Fig. 1.

Total sales prices or prices per acre of property in other dam sites and reservoir basins vary over a wide range, and are influenced by such a wide variety of factors known and unknown, as to be of little assistance in determining market value. Frequently such property is acquired at very low prices per acre from an owner who has no knowledge of their utility for storage purposes, or at an extremely high acreage price because of expensive improvements. Again, one buyer may pay $100,000 for a dam site containing 50 acres, or $2,000 per acre, because he finds he can construct a dam thereon that will store 100,000 acre-ft at a cost of $1,000,000, while another site of 100 acres may be purchased for $50,000, or $500 per acre, because it will cost $1,500,000 to construct a dam thereon creating 100,000 acre-ft of storage capacity.

Again, a price of $100,000 may be paid for each of two sites, both having a capacity of 50,000 acre-ft. One site may have an area of 500 acres, and cost $200 per acre, while the other with an area of 1,000 acres, will cost $100 per acre. An appraiser should be informed of such sales prices, but seldom should he give them much weight.

It is not possible to determine the market value of any two reservoir sites, or for that matter, of any two specialties, by following identical methods or procedure. If the appraiser, however, bears in mind that he must determine the adaptability of the property to reservoir use and the probability that it will be sought for development for storage purposes within a reasonable future period; and that the purchasers who can be

expected to acquire it will be seeking, not real estate, but a site upon which storage capacity can be created at the lowest possible cost for development and utilization, he will develop his method and procedure with little difficulty, using the foregoing as a general guide.

The same approach will apply to the determination of market value of other specialties. The appraiser must determine their highest and best use, who might be expected to buy them for such use and when, and the highest price that such purchasers can afford to, and therefore will, pay. He can likewise assume that an owner, knowing that such price is the highest he can expect to receive, will therefore accept it.

FWA Reports Progress on Fully-Planned Public Works

(*Continued from page 41*)

ernments have plans in the design stage for public works with an estimated construction cost of $4,124,009,000, but, the report says, the rate of progress in bringing these plan preparations from the design stage to completion has been slow. Programs of state planning aid to local governments have been set up in New York, California, Michigan, Illinois, Pennsylvania, New Jersey, Maryland, and Indiana. Except for Indiana—which makes loans—these state planning-aid programs provide grants up to one-half the planning costs of approved projects.

Of 12,631 governmental units reporting on plan preparations without federal assistance, 7,438 had no plans in either the completed or the design stage. These included one state government, 1,601 counties, 3,470 cities, townships and towns, 2,235 separate school districts and 131 special districts. Most of the cities, townships and towns reporting no planning were of 10,000 population or less, but they included 273 with populations of more than 10,000, and of these, 28 are cities of more than 50,000 population.

The report also gives data from the Public Roads Administration, FWA, which show that in the 48 states, the District of Columbia, Hawaii and Puerto Rico, as of December 31, 1946, plan preparations had been completed for federal-aid and state highway projects with an estimated construction cost of $804,318,000, and plans were in the design stage for projects with an estimated construction cost of $1,926,521,000.

The dollar volume of all these different categories of proposed public works is not to be added together, the report points out, as they cover not only plans completed or assured of completion with federal aid, and plans completed without federal aid, but also plans brought to the design stage without federal assistance, the completion of which is uncertain.

Remarking that "there is no occasion to turn to works of doubtful usefulness in building up a reserve," the report notes that sewer, water and sanitation facilities, with schools and other educational facilities, are leading the types of public works for which federal advances have been approved. The same types also bulk large among state and public works thus far planned without federal assistance.

"Yet," says the report, "all the public works of these types thus planned, or being planned, constitute only a fraction of those for which an urgent need exists.

"The same is unmistakably true at the present time for community facilities of all types—the recognized need vastly exceeds the volume of plan preparations. There is no thought of encouraging the planning of any but the most useful and needed public construction."

At the end of December, the advance planning program had been in operation approximately a year and a half. During that period, a total of $62,917,000 had been made available for apportionment among the states as planning advances. Applications on hand called for advances totaling $33,696,518, or about twice the $16,310,237 which the Bureau of Community Facilities still had available.

Pollution Abatement Program Proposes Plant for 100 Cities

(*Continued from page 23*)

200 miles of collecting sewers and interceptors along the rivers, valleys, and tributaries, picking up the sewage now being discharged directly into the streams and diverting it to the treatment works. If this solution to the problem is too costly, other projects will be developed to determine the best arrangement and the least number of treatment plants which can be used.

First Phase Completed

The first phase of our work has been completed. This consisted of measuring the amount of sewage and the rate of flow in 33 main sewer outlets in the county. The daily discharge of sewage, not including industrial wastes, into the streams exceeds 200,000,000 gal.

Allegheny County Sanitary Authority engineers and chemists are now engaged in checking the industrial wastes originating from more than 2,000 plants located in the county. Later on, they will concentrate on a phase of the work which has already been started, the compilation of water service data from 49 public and private water companies serving the district. Sewer rental charges will be computed from the amount of water used.

Toward the close of the coming year the staff will be engaged in correlating the information gained earlier, on which the report on the preliminary plans will be based. This report will be released on or before January 1, 1948. After it has been studied and approved by officials of the state and of the communities interested, contracts will be negotiated with the communities, bonds will be sold, and construction will begin.

Method Determines Degree of Fixity in Footings

(*Continued from page 44*)

For $s = 2.0$ kips per ft^2, $b = 4.0$ ft, $c = 2.5$ ft, $a = 0.625$, and $M_f = 29.90$ kip-ft, Eq. 3 gives:

$$m = \frac{0.625 \times 2.0 \times 4.0^3}{12 \times 29.90} = 0.223$$

and according to Eq. 4, $M_i = 0.223 \times 29.90 = 6.67$ kip-ft. Contrary to the assumption of hinges in the design, a moment is induced in the frame which is about 22 percent of the moment of complete fixity.

Conversely, for a given value of 2.0 kips per ft^2 for s, and of 0.625 for a, with 50 percent fixity, or $M_i = 6.67$ kip-ft, Eq. 5 gives,

$$b^3 = \sqrt{\frac{12 \times 6.67}{0.625 \times 2.0}} = 4.0 \text{ ft}$$

and $c = 0.625 \times 4.0 = 2.50$ ft.

A slight inaccuracy enters into these calculations because of the assumption that the horizontal thrust remains constant. A change in the value of the thrust will affect, of course, the eccentricity in the footing. However, this influence is not important and can be neglected. For instance, the induced moment of 6.67 kip-ft corresponds to a thrust of 3.08 kips, as compared with a thrust of 3.00 kips in the case of a two-hinged frame.

APPLICATIONS FOR ADMISSION OR TRANSFER

March 1, 1947 — Number 3

The Constitution provides that the Board of Direction shall elect or reject all applicants for admission or for transfer. In order to determine justly the eligibility of each candidate, the Board must depend largely upon the membership for information.

Every Member is urged, therefore, to scan carefully the list of candidates published each month in CIVIL ENGINEERING *and to furnish the Board with data which may aid it in determining the eligibility of any applicant.*

It is especially urged that a definite recommendation as to the proper grading be given in each case, inasmuch as the grading must be based upon the opinions of those who know the applicant personally as well as upon the nature and extent of his professional experience. Any facts derogatory to the personal character or professional reputation of an applicant should be promptly communicated to the Board. Communications relating to applicants are considered strictly confidential.

The Board of Direction will not consider the applications herein contained from residents of North America until the expiration of 30 days, and from non-residents of North America until the expiration of 90 days from the date of this list.

MINIMUM REQUIREMENTS FOR ADMISSION

GRADE	GENERAL REQUIREMENT	AGE	LENGTH OF ACTIVE PRACTICE	RESPONSIBLE CHARGE OF WORK
Member	Qualified to design as well as to direct important work	35 years	12 years	5 years
Associate Member	Qualified to direct work	27 years	8 years	1 year
Junior	Qualified for subprofessional work	20 years	4 years	
Affiliate	Qualified by scientific acquirements or practical experience to cooperate with engineers	35 years	12 years	5 years

APPLYING FOR MEMBER

BASTOS, A. BRITO (Age 51) Chf., Planning Branch, U.S. Engrs., Tulsa, Okla.

BAULSIR, CHARLES PALMER (Age 41) Associate, Parsons, Brinckerhoff, Hogan & Macdonald, Engrs., New York City.

BOYD, WILLIAM KEITH (Age 41) Chf., Flexible Pavement Branch, Soils Div., U.S. Waterways Experiment Station, Vicksburg, Miss.

BULL, CHARLES MAYRANT (Age 48) Asst. Gen. Mgr., Avondale Marine Ways, Inc., Westwego, La.

CALLAHAN, DANIEL EDWARD (Age 48) Engr., Rapid Transit Lines, Boston Elevated Ry Co., Malden, Mass.

CAMP, CECIL SIDNEY (Assoc. M) (Age 39) Assoc. Prof. of Hydr. & San. Eng., Univ. of Tenn., Knoxville, Tenn.

CLARE, HERBERT CECIL (Age 43) Director, Div. of Public Health Eng., Idaho Dept. of Public Health, Boise, Idaho.

DARRELL, GEORGE CHARLES (Age 52) Contract Supt., Ellerbe & Co., Archts., St. Paul, Minn.

DETWEILER, JOHN CONNETT (Assoc. M.) (Age 47) Water Engr., Metropolitan Utilities Dist., Omaha, Nebr.

DWYER, JOHN JOSEPH (Age 40) Cons. Engr., Andrews & Clark, New York City.

DYE, FORREST LESLIE (Assoc. M.) (Age 40) Senior Engr., Chf. of Dredging Sec., Special Eng. Div., The Panama Canal, Diablo Heights, Canal Zone.

EXUM, JAMES POWERS (Assoc. M.) Bridge Engr., Texas Highway Dept., Austin, Tex.

FITZGERALD, JOHN MICHAEL (Age 59) Deputy Chf. Engr., New York City Board of Water Supply.

GALLINGER, RALPH HENRY (Age 40) Senior Engr., War Dept., Corps of Engrs., Buffalo, N.Y.

GLAZE, ROLAND AEBHART (Age 41) Chf. Engr., Weyerhaeuser Sales Co., St. Paul, Minn.

GROSS, JOSEPH WILLIAM (Assoc. M.) (Age 42) Civ. Eng. V (Executive), Board of Wayne County, Mich., Road Commissioners, Detroit, Mich.

HARPER, JAMES EDWARD, JR. (Age 37) Col., Corps of Engrs., U.S. Army, being asst. to Pres., Mississippi River Comm., Vicksburg, Miss.

HATFIELD, WILLIAM PAUL (Assoc. M) (Age 49) Superv. Engr., RFC, St. Louis, Mo.

HAZEN, CHARLES SHERMAN (Age 37) Project Planning Engr., Bureau of Reclamation, Kalispell, Mont.

HENRY, JAY EVERETT (Age 38) City Engr. & Director, Public Works, Wheeling, W.Va.

HOFFBERG, WILLIAM ARNOLD (Assoc. M) (Age 42) Cons. Engr., New York City.

IORNS, WILLIAM VAUGHN (Assoc. M) Project Engr., U.S. Geological Survey, Logan, Utah.

JOHNSON, TOM ROYSE (Assoc. M.) Commander CEC, U.S. Naval Station, Public Works Dept., Tacoma 2, Wash.

KAHALE, SOUBHI (Jun.) (Age 35) Director of Public Works, Amman, Trans Jordan.

KEPNER, HAROLD RAYMOND (Assoc. M.) Prof. of Civ. Eng., Utah State Agricultural Coll., Logan, Utah.

KUHL, LEWIS CHARLES, JR. (Assoc. M.) Project Engr., Turner Constr. Co., New York City.

LECLERCQ, EMILE PAUL Assoc. (M.) San. and Hydr. Engr., Gibbs & Hill, Cons. Engr., Englewood, N.J.

LIBBY, CHARLES JAMES (Age 51) Designing Engr., Robbins-Ripley Co., New York City.

LIN, TUNG YEN (Jun.) (Age 35) Asst. Prof. Civ. Eng., Univ. of California, Berkeley, Calif.

LOIDA, JOSEPH LOUIS (Assoc. M.) Chf. Engr., Illinois Terminal R.R., St. Louis, Mo.

LUNDY, THOMAN EMMETT (Assoc. M.) Design Engr., Koch & Fowler, Cons. Engrs., Grand Prairie, Tex.

LUTZ, JOSEPH CARL (Age 57) Chf. Engr., St. Paul Union Stockyards Co., and St. Paul Bridge & Terminal Ry. Co., St. Paul, Minn.

LYON, GEORGE ALBERT (Assoc. M.) Archt., Logan, Utah.

MCGAVOCK, JOHN HICKMAN (Age 35) Administrative Officer, Sverdrup & Parcel, Cons. Engrs., St. Louis, Mo.

MCLEAN, LEAL CAREY HENRY (Age 42) Chf. Engr., Jones & Laughlin Steel Corp., New Orleans, La.

MARKWARDT, LORRAINE JOSEPH (Age 57) Asst. Director, Forest Products Laboratory, Forest Service, U.S. Dept. of Agriculture, Madison, Wis.

MINER, CLARENCE CROSIAR (Assoc. M.), Associate Civ. Engr., U.S. Bureau of Reclamation, St. George, Utah.

MOORE, GLENN WILLIAM (Age 38) Lt. Col., U.S. Army Engrs.

MORRIS, JOHN RYAN (Age 37) Head of Structural and Civ. Engr. Dept., A. M. Kinney, Inc., Cons. Engrs. and Archts., Covington, Ky.

NEEL, CHARLES HERBERT (Jun.) (Age 35) Comdr., CEC, U.S. Navy, New York City.

NEFF, PAUL JOSEPH (Age 62) Pres. and Chf. Executive Officer, Missouri-Pacific Lines, St. Louis, Mo.

OSTENFELD, CHRISTEN (Age 46) Cons. Engr., Klampenborg, Denmark.

PAINTER, CARL ELLIOTT (Assoc. M.) (Age 55) Vice-Pres. and Cons. Engr., Waterworks Equipment Co., Salt Lake City, Utah.

PATON, ANDREW CURRIER (Age 37) Chf. Engr., The Henley-Lundgren Co., Shrewsbury, Mass.

POUND, HOWARD JEWELL (Age 46) Engr. (P-2 to P-6), Bureau of Reclamation, Denver, Colo.

RADFORD, ROBERT ARMSTRONG (Age 59) War Assets Administration, appraising major war industrial plants.

REES, WILLIAM ROSS (Age 50) Dist. Engr., Atchison, Topeka & Santa Fe. R.R., La Junta, Colo.

RODGERS, WILLIAM WERNER (Age 43) Member, Eng. Staff, Hercules Powder Co., Wilmington, Del.

ROGAN, JOHN EDWARD, JR. (Jun.) (Age 35) Supervisor of Track, Illinois Central R.R., Cunton & McComb Dists., McComb, Miss.

ROTHSCHILD, RICHARD ADLER (Age 42) Associate and Chf. Engr., Sherlock, Smith & Adams, Archts. and Engrs., Montgomery, Ala.

SAGER, JOHN CHOWNING (Age 43) Maintenance Engr., Minneapolis-St. Paul San. Dist., Minneapolis, Minn.

SHAH, SAMIULLAH (Age 52) Principal, Eng. Coll., Hyderabad-Deccan, India.

SHUGART, DONALD FIELD (Age 47) Cons. Structural Engr., Beverly Hills, Calif.

SPEERT, JULIUS LOUIS (Assoc. M.) (Age 41) Electronic Engr., U.S. Geological Survey, Dept. of Interior, Washington, D.C.

SPELMAN, WILLIAM ANGELL (Age 61) Chf. Engr., Frederick L. Cranford, Inc., Rochelle Park, N.J.

STAMPER, HARRY NEWTON (Age 47) Constr. Engr., Humble Oil & Refining Co., Houston, Tex.

STAUDER, ARTHUR OSCAR (Assoc. M.) Bridge Engr., Illinois Div. of Waterways, Bureau of Bridges, Chicago, Ill.

THOLIN, ALBERT LINNE (Age 47) Engr. of Sewer Design, Bureau of Sewers, Chicago, Ill.

VOLLMER, VICTOR ALLEN (Assoc. M.) (Age 52) Asst. Chf. Structural Engr. with Ellis Wing Taylor, Arch. and Engr., Los Angeles, Calif.

WAITE, JOSEPH, JR. (Age 51) Asst. Engr., City of Durham, N.C.

WERNTZ, CHARLES GARNER (Age 42) Engr., American Bitumuls Co., Annapolis, Md.

WILSON, MILTON THEURER (Age 48) Dist. Engr., Water Resources Branch, U.S. Geological Survey, Salt Lake City, Utah.

WITHEY, MORTON OWEN (Age 64) Dean, Coll. of Eng., Univ. of Wisconsin, Madison, Wis.

APPLYING FOR ASSOCIATE MEMBER

ANDREWS, LOUIS CULLEN (Age 40) Member of firm and Pres., Crescent Steel & Erection Co., New Orleans, La.

AYERS, MAURICE THURBER (Age 38) Assoc. Prof., Rutgers Univ., Livingston, N.J.

BERG, GLEN VIRGIL (Age 28) Engr., Special Eng. Div., The Panama Canal, Diablo Heights, Canal Zone.

BIDWELL, WAYNE MCGRANAHAN (Age 52) Hydr. Engr. (P-3), International Boundary Comm., El Paso, Tex.

BISHOP, LOREN EMERSON (Age 35) Engr. (P-3), U.S. Bureau of Reclamation, Grandby, Colo.

BJORK, JOHN HERBERT (Age 56) Engr., Bureau of Reclamation, All-American Canal, Coachella, Calif.

BRANT, ROGER WILLIAM (Jun.) (Age 35) Cons. and Maintenance Engr., Wells Fargo Bank & Union Trust Co., Oakland, Calif.

COLLINS, CECIL FRANKLIN (Age 38) Engr., Foundation Dept., Donald R. Warren Co., Los Angeles, Calif.

CORNELL, HOLLY ADAMS (Jun.) (Age 32) Private practice, Corvallis, Ore.

COSTINETT, JOHN HARRISON (Jun.) (Age 33) Supervisor of Mechanical and Utilities Unit, Veterans Administration, Branch 5, Atlanta, Ga.

CRUTCHER, JAMES WHITMORE (Jun.) (Age 34) Commanding Officer, Company Grade, 313 Engrs. Bn., 88th Div., 391st Station Hospital, Meadville, Pa.

DACQUISTO, ANGELO ARNOLD (Age 32) Asst. Engr. (Civ.), U.S. Engr. Office, Syracuse, N.Y.

DELLA ROCCA, RALPH JOSEPH (Age 28) Structural Engr., Edwards & Hjorth, Cons. Engrs., New York City.

DEMERITT, GEORGE WESLEY (Jun.) (Age 34) Associate Hydr. Engr., U.S. Engr. Office, Galveston, Tex.

DICKERSON, LEWIS ADDISON (Jun.) (Age 34)

Civilian Photogrammetric Engr., P-5, Army Map Service, Washington, D.C.

DOUGHERTY, HENRY WARD (Age 32) Field Engr. Portland Cement Association, Memphis, Tenn.

DOWD, GAYLORD CLARK (Jun.) (Age 34) Vice-Pres. Louis C. Kingscott & Associates, Inc., Archts. and Engrs., Kalamazoo, Mich.

EL-KASHEF, ALI FAHMI (Age 27) Sent by Ministry of Public Works for 2-year scholarship in U.S.; at present in Baltimore, Md.

FELLER, RICHARD TABLER (Jun.) (Age 27) Vice-Pres., Huber, Hunt & Nichols, Inc., Indianapolis, Ind.

FISCHBACK, ALEXANDER ANTONE, JR. (Age 39) Assoc. Engr. (Hydr.), U.S. Geological Survey, Tucson, Ariz.

FLORES, RODRIGO (Age 34) Cons. Engr., Pacific Steel Corp., New York City.

FREDERICK, WILLIAM LAWRENCE (Age 36) Highway Engr. (P-2), FWA, PRA, Madison, Wis.

GILTNER, LOU WALLACE (Age 48) Civ. Engr. (P-4), U.S. Navy, Naval Air Station, Oahu, Hawaii.

HANDSMAN, EMANUEL (Age 40) Asst. Engr., Buck, Siefert & Jost, New York City.

HEMPEL, HUGH WILLIAM (Age 36) Structural Designer with Stearns-Roger, Denver, Colo.

HIGH, EDWARD LOUIS (Age 40) Dist. Planning & Programming Engr., U.S. PRA, Madison, Wis.

HILLIS, LEONARD FOLSOM (Age 41) Associate Prof. of Civ. and Structural Eng., Univ. of Wisconsin, Madison, Wis.

HUSS, DONALD CALFEE (Age 40) Civ. Engr. (P-3), Bureau of Reclamation, Phillipsburg, Kans.

JANES, MILO F. (Age 46) Structural Engr., Edwards & Hjorth, Engrs., New York City.

JENKINS, JOSEPH EDWIN (Jun.) (Age 32) San. Engr., Texas Board of Health, Ft. Worth, Tex.

JORGENSEN, HOMER WILLIAM (Jun.) (Age 32) San. Engr. and Chf. Draftsman, Los Angeles County Sanitation Dists., Los Angeles, Calif.

JOSEPH, JOSEPH ALBERT (Jun.) (Age 34) Asst. Prof. of Civ. Eng., Univ. of Missouri, Columbia, Mo.

JOYCE, JOSEPH PETER, JR. (Jun.) (Age 36) Structural Designer, Bridge Div., Dept. of Highways, Cook County, State of Illinois, Oak Park, Ill.

KANE, HENRY HORACE (Age 42) Res. Engr., on King George Dock Extensions, Calcutta, India.

KENSLEY, PHILLIP RAY (Jun.) (Age 35) Civ. Engr. (P-4), U.S. Engrs., Seattle, Wash.

KOHLER, MAX ADAM (Age 31) Hydrologic Engr. (P-4), Procedure Development Sec., Climatological and Hydrological Service Div., Washington.

LENFEST, LESLIE WELLMAN (Age 31) Hydr. Engr. (P-2), U.S. Geological Survey, Water Resources Branch, Ithaca, N.Y.

LLANOS, MAURO (Age 39) Chf. Engr., Soil & Pavements, Highway Dept., Lima, Peru.

MCCLURG, RICHARD HARVEY (Age 31) Engr.-Designer, Albert Kahn Associated Archts. & Engrs., Detroit, Mich.

MCGAVOCK, CECIL BILLUPS, JR. (Jun.) Geologist (P-3), Corps of Engrs., Seattle, Wash.

MCMAHON, CHARLES ALBERT (Age 31) at present graduate student, Univ. of Colo., Boulder, Colo.

MANN, GEORGE BOLEY (Jun.) (Age 34) Engr. Chf., Controlled Soil Testing Sec., Automotive Div., D&PS, Aberdeen Proving Grounds, Md.

MARTIN, DAVID CURTIS (Age 42) Structural Designer, General Elec. Co., Schenectady, N.Y.

MOSTAFA, HASAN HASAN (Age 35) Member Egyptian Govt. Education Mission to study engineering in America, Syracuse, N.Y.

MUNOZ DELABORDE, CARLOS (Age 32) Engr. Central Hydr. Works Service, Ministry of Public Works, Madrid, Spain.

NACHMAN, BERNARD MICHAEL (Age 34) Associate Engr., Asst. Chf., Eng. Div., Res. Engr.'s Office, Allatoona Dam, War Dept., Cartersville, Ga.

NELSON, HOWARD COLLINS (Age 32) Field Engr. with A. B. Mason, Civ. Engr., San Benito, Tex.

NORMAN, CLARENCE C. (Age 41) Asst. Prof., Civ. Eng. Dept., Clemson Agricultural Coll., Clemson, S.C.

ODELL, EDWARD EVERETT (Age 32) Asst. Engr., Chiriqui Land Co. Puerto Armuelles, Panama.

ORHON, EKREM (Jun.) (Age 35) Contr., Rize, Turkey.

OUSTAD, CARL BERGER (Age 48) Associate Civ. Engr., Public Works Office, U.S. Naval Air Station, Alameda, Calif.

PARRISH, KARL CALVIN, JR. (Jun.) (Age 34) Mgr. and Superv. Engr., Parrish & Co., Barranquilla, Colombia.

PELLER, PHILLIP ALLEN (Jun.) (Age 34) Harbor Engr., Ministry of Communications of Chinese Govt., Tientsin, China.

PEMBERTON, CARLYSLE, JR. (Age 29) Engr. (Hydr.) P-3, U.S. Engr. Office, Louisville, Ky.

PORGES, RALPH (Jun.) (Age 34) San. Engr. (Major), U.S.P.H.S. Dist. Office, San Francisco, Calif.

PRICE, JOSEPH WILSON (Age 46) Associate Engr. Constr., U.S. Engr. Dept., San Francisco, Calif.

PUTMAN, CLARENCE (Jun.) (Age 34) Civ. Engr., II, Maps and Surveys Div., TVA.

QUATTLEBAUM, ALEXANDER MCQUEEN (Jun.) (Age 33) Chf. Engr., Quattlebaum Eng. Co., Johnston, S.C.

QURESHI, ABDUR RASHID (Age 37) Member of deputation sent by Govt. of India to study and examine highway construction methods in United Kingdom and United States.

RANDALL, GIFFORD MYRON (Jun.) (Age 31) Office Engr., Kaiser Engrs., Inc., Oakland, Calif.

RAO, JOSYULA VISWESWARA (Age 30) Asst. Research Officer, Irrigation Research Station, Madras, India.

REECE, GEORGE MATTHEW (Jun.) (Age 33) Major, Corps of Engrs., U.S. Army, Dorchester, Mass.

ROUNTREE, JACK ROBERTS (Jun.) (Age 32) Civ. Engr., Design Dept., TVA, Knoxville, Tenn.

ROUNTREE, SEABORN REUBEN, JR. (Jun.) (Age 34) Chief Draftsman, Dept. of Public Works, Austin, Tex.

SHARP, JAMES FRANCIS (Jun.) (Age 34) Asst. City Planning Engr., City Planning Comm., Nashville, Tenn.

SLOSS, DONALD WEBSTER (Jun.) (Age 34) Associate San. Engr., U.S. Army Engrs., Los Angeles, Calif.

STANDISH, JOHN HERBERT (Age 37) Asst. Res. Engr., State River & Water Supply Comm., Melbourne, Australia.

STERENBERG, LEO AARON (Jun.) (Age 34) Area Supervisor, U.S. Public Health Service, Camp Kilmer, N.J.

TATE, ELBERT JOSEPH (Age 31) Civ. Engr. (private practice), Ventura, Calif.

TOPPEN, THEODORE SAMUEL (Jun.) (Age 34) In office of Inter-American Geodetic Survey, Guatemala City, Guatemala.

VAIDYANATHAN, PERINGARA HARIHARA (Age 36) Sent to U.S. by Govt. of India for training in Bureau of Reclamation, Denver, Colo.

WAMSTAD, CHARLES OSCAR (Jun.) (Age 35) Office Engr., U.S. Bureau of Reclamation, Klamath Falls, Ore.

WELTY, WILLIAM ROBERTSON (Jun.) (Age 34) Asst. Traffic Engr., Texas Highway Dept., Austin, Tex.

WITHOLDER, ALFRED HENRY (Age 42) Asst. Engr. International Boundary and Water Comm., U.S. Sec., El Paso, Tex.

APPLYING FOR AFFILIATE

BRASHEARS, MAURICE LYMAN, JR. (Age 38) Dist. Geologist, U.S. Geological Survey, New York and New England, Jamaica, N.Y.

VOTAW, GEORGE JULIAN (Age 40) Henderson & Votaw, Archts., Palm Beach, Fla.

APPLYING FOR JUNIOR

AL-HAKIM, BAHIJ (Age 23) Graduate student, Univ. of Minnesota, Minneapolis, Minn.

ALLEN, ROBERT DAVID (Age 24) Surveyor, Southern Pacific R.R. Co., Ogden, Utah.

ARZE, ELIAS (Age 27) Asst. Prof., Univ. of Chile.

BRENNAN, PAUL JOSEPH (Age 26) Instrumentman, W. E. Wood Constr. Co., New Haven, Conn.

BRIGGS, LEROY FRANK (Age 24) Teacher, Civ. Eng. Dept., Tufts Coll., Medford, Mass.

CHATURVEDI, ABINASH CHANDRA (Age 23) Engr. Student, Irrigation Dept., PWD, United Provinces, India.

COETSEE, ANDREAS (Age 22) Asst. Engr., Municipality of Bloemfontein, South Africa.

CORREAL, HERNANDO (Age 26) Graduate student, Univ. of Michigan, Ann Arbor, Mich.

DICKINSON, WILLIAM EDWARD (Age 27) Civ. Engr., Calcium Chloride Association, Washington, D.C.

ELLER, CLYDE BLAINE (Age 25) Graduate student, Univ. of Michigan, Ann Arbor, Mich.

FISH, FREDERICK C. (Age 27) Engr., Klug & Smith Co., Milwaukee, Wis.

GOLDENTHAL, MITCHEL (Age 26) Graduate student, Agricultural & Mechanical Coll. of Texas, College Station, Tex.

GUPTA, HARI MOHAN (Age 24) Asst. Engr., PWD, Govt. of United Provinces, India.

ISMAIL, HASSAN MOHAMMED (Age 29) Cal. Tech. graduate student, California Inst. of Technology, Pasadena, Calif.

KALT, ROBERT ERVIN (Age 32) Engineer (Civil) Klug & Smith Co., Contr. & Cons. Engrs., Milwaukee, Wis.

LOGAN, DOUGLAS HAIG (Age 29) Project Engr., Arillano & Mendoza, Contrs., Archts. & Engrs., Havana, Cuba.

LUNDSTROM, GEORGE MATTIUS (Age 25) Designing Struc. Engr., Kimberly Clark Co., Neenah, Wis.

MABRY, AUBON LESLIE (Age 30) Civ. Engr. (P-1), Corps of Engrs., U.S. Army, New Orleans, La.

MIAN, IRSHAD NABI (Age 21) Graduate student, Univ. of Minnesota, Minneapolis, Minn.

MOORE, LEROY WILBER (Age 26) Duluth, Minn.

PETRELLI, JOSEPH ANTHONY (Age 26) Asst. Engr., Socony Vacuum Oil Co., New York City.

RAY, MARL ELLIS (Age 31) Structural Designer with W. Henley Deitrick, Inc., Architect, Raleigh, N.C.

REXACH, RALPH (Age 31) Structural Designer, Wilcox & Erickson, Cons. Engrs., New York.

RHODES, JAMES ARTHUR (Age 32) Engr. (Hydr.), U.S. Engr. Office, Norfolk, Va.

SARANTES, GEORGE NICHOLAS (Age 27) Structural designer, Associated Engrs., Springfield, Mass.

SARKARIA, GURMUKH SINGH (Age 21) Graduate student, Brooklyn Poly. Inst., Brooklyn, N.Y.

SCHMIDT, GEORGE EDWARD (Age 24) Structural designer, Rust Eng. Co., Pittsburgh, Pa.; address Alton, Ill.

SHRIKANT, RANBIR SINGH (Age 24) Govt. of India Sponsored Trainee in U.S., Bureau of Reclamation, Denver, Colo.

SINGH, GURCHARN (Age 22) with Bureau of Public Works, Punjab, India.

TOTH, ALBERT STEVEN (Age 29) Asst. Hydr. Engr., U.S. Geological Survey, New York City.

ALA. POL. INST.

	AGE
BANKS, WILLIAM EDWARD, 1946	(31)

UNIV. OF CALIF.

MARTIN, JOHN ALFRED, 1943	(27)

CLEMSON AGRI. COLL.

FORD, JOHN MARTIN, JR. 1946	(25)
SMOYER, EZIO, 1946	(25)

UNIV. OF COLO.

BROMBERG, MILTON, 1946	(22)
CONRADO, CHARLES D., 1946	(28)
DOAK, ROBERT, 1946	(24)
FIKANY, EDWARD JOSEPH, 1946	(23)
HUEFTLE, MAX WELDON, 1946	(24)
PEPER, ROBERT KENNETH, 1946	(25)
RAUTENSTRAUS, ROLAND CURT, 1946	(23)

DUKE UNIV.

RAGSDALE, LEE MORRIS, JR., 1946	(20)

UNIV. OF FLA.

HARDAKER, PAUL HINSON, 1943	(25)

GA. SCHOOL TECH.

HAWKINS, GLENN JOHN, 1947	(26)
JAFFE, MAX, 1946	(26)

HARVARD COLL.

RIDDELL, MATTHEW DONALD RUTHERFORD, 1940 and 1946	(28)

UNIV. OF LOUISVILLE

CHAFIN, JOHN LIVINGSTON, 1946	(23)

MANHATTAN COLL.

VECCHIO, ANGELO THOMAS, 1944	(22)

MARQUETTE UNIV.

JUEDES, ROGER J., 1945	(23)

MASS. INST. TECH.

HOLT, EDWARD CHESTER, JR. 1945	(23)
SULLIVAN, JOHN FRANCIS, 1946	(21)

MICH. STATE COLL.

RUSHMAN, GLENN ARTHUR, 1946	(26)

UNIV. OF MO.

BUCHERT, KENNETH PETER, 1945	(23)

COLL. OF CITY OF N.Y.

ROSSELLI, ALBERT THOMAS, 1945	(20)

PA. STATE COLL.

FINKEL, HARTLEY KENNETH, 1946	(21)
SCHULLER, DONALD MILL, 1947	(25)

RENS. POL. INST.

DIAMOND, BENJAMIN HERMAN, 1947	(21)
DIRIKER, EKMEL NECIP, 1947	(22)
SUBKOWSKY, HARRY, 1947	(23)

UNIV. OF TENN.

REGENOLD, WILLIAM SHANNON, JR., 1946	(25)

AGRI. & MECH. COLL. OF TEX.

CLONINGER, KRISS, JR., 1947	(25)
MARSHALL, THOMAS WARREN, 1947	(23)

TULANE UNIV.

HINSON, ROBERT DOWLING, 1947	(23)

VA. POLY. INST.

CARDER, WILLIAM HENDERSON, 1946	(23)

VILLANOVA COLL.

COX, BURTON NOWLIN, JR., 1946	(21)

UNIV. OF WIS.

WEST, ROBERT PAGE, 1946	(22)

The Board of Direction will consider the applications in this list not less than thirty days after the date of issue.

CHANGES IN MEMBERSHIP GRADES

ADDITIONS, TRANSFERS, REINSTATEMENTS, AND RESIGNATIONS

From January 10 to February 10, 1947, Inclusive

Additions to Membership

ACUFF, JOHN EMMETT, JR. (Jun. '46), Engr. (Civ.) P-2, U.S. Engrs., Nashville Dist., Wolf Creek Dam, Jamestown, (Res., Wolf Creek Dam, Long Bottom), Ky.

ALLABACH, EARL PETER (M. '46), Cons. Engr., 1933 Commercial Trust Bldg., Philadelphia (Res., Box 133, Trevose), Pa.

ALTOBELLIS, JULIAN ARTHUR (Jun. '46), Structural Designer, J. J. Pollard, Archt. and Engr., Care, Dept. of Architecture, Georgia School of Technology, Atlanta, Ga.

ANDREWS, CARL HANSON (M. '46), Senior Engr. (Civ.), Southwestern Div., Corps of Engrs., 1114 Commerce St., Dallas 2, Tex.

ARMSTRONG, URAL STOKES (Assoc. M. '46), Project Engr., State Highway Dept., Santa Fe, N.Mex.

ASHTON, EDWARD RALPH (Jun. '47), Asst. Engr., P. J. Walker Co., 3900 Whiteside Ave. (Res., 1052 Redondo Blvd.), Los Angeles 35, Calif.

BAKER, ROBERT FULTON (Assoc. M. '46), Materials Engr., State Highway Dept., 132 Graham Ave., Lexington 29, Ky.

BANGHAM, WILLIAM LARRIBEE (Assoc. M. '46), Chf. Engr.-Partner, Subdivision Eng. Co., 5606 Sunset Blvd., Los Angeles (Res., 100 North Wilson Ave., Pasadena 4), Calif.

BANKS, HAROLD ELTON (Assoc. M. '46), Engr., The McDowell Co., 3203 West 71st St., Cleveland (Res., 1600 Parkwood Road, Lakewood 7), Ohio.

BARTLETT, WESLEY JAMES (Jun. '46), Junior Engr., Rollin F. MacDowell, 401 Chester—12th Bldg. (Res., 4168 West 49th St.), Cleveland 9, Ohio.

BARTZ, ALBERT WILLIAM (M. '46), Care, Aluminum Co. of America, 801 Gulf Bldg., Pittsburgh 19, Pa.

BELGIN, ADIL (Jun. '47), Graduate Student, Univ. of Michigan, 513 South Division St., Ann Arbor, Mich.

BELL, JOHN STEPHEN (Jun. '46), Civ. Engr., State Div. of Waterways, 201 West Monroe St., Springfield, Ill.

BENEL, HAROLD FRANCIS (Jun. '46), Junior Civ. Engr., Board of Transportation, 481 Morris Park Ave. (Res., 210 Sixth Ave.), New York, N.Y.

BENNETT, WILFORD S. (Assoc. M. '46), Civ. Engr., Flood Control Design, Corps of Engrs., Louisville Dist., Gibbs-Inman Bldg. (Res., 265 Claremont Ave.), Louisville 6, Ky.

BENTSON, ROBERT JOSEPH, JR. (Jun. '46), Engr.-Draftsman, The Pure Oil Co., 35 E. Wacker Dr. (Res., 8146 Champlain Ave.), Chicago, Ill.

BOOTH, CHESTER EDWIN (M. '46), Civ. Engr., Ebasco Services, Inc., 2 Rector St., Room 1340, New York, N.Y.

BOSCHEN, HENRY CHARLES (M. '47), Vice-Pres., Raymond Concrete Pile Co., 140 Cedar St., New York, N. Y.

BROOK, EDWARD JOSEPH (M. '46), Asst. to the Pres., Franco Wyoming Oil Co., 611 Ellison Bldg., Los Angeles 13, Calif.

BROWN, EARL IVAN (Jun. '47), Instr., Dept. of Civ. Eng., North Carolina State College (Res., P. O. Box 5828), Raleigh, N.C.

BURKE, GEORGE EDWARD (Jun. '46), Junior Engr. (Designer), Russell & Axon, Cons. Engrs., 6635 Delmar Blvd., University City 5, Mo. (Res., P.O. Box 588, Morristown, N.J.)

BURKE, JASPER RICHARD (M. '46), Comdr., CEC, U.S.N., 33 Oceanside Rd., Rockville Centre, N.Y.

BURNETT, RICHARD EDWARD (Assoc. M. '47), Engr., Civ., U.S. Bureau of Reclamation, P.O. Box 357, Escondido, Calif.

BYERS, ROBERT EDGAR (Jun. '46), Field Engr., State Highway Dept., P.O. Box 168, Rule, Tex.

CALDERA, DAYTON JOSEPH (Jun. '46), Engr., Esso Standard Oil C.A.S.A. (Res., P.O. Box 84), Managua, Nicaragua, C.A.

CARDENAL ARGUELLO, LUIS GONZAGA (Jun. '46), (Cardenal-Lacago Fiallos Cia Ltd.), Managua D.N., Nicaragua Managua D.N., Nicaragua, C.A.

CARLEY, WILLIAM JEFFERSON (Jun. '46), Instr. in Civ. Engr., Clarkson College of Technology, 51 Main St., Potsdam, N.Y.

CARPENTER, JOHN MORTON (Jun. '47), Asst. City Administrator, City of Ames, City Hall, Ames, Iowa.

CARR, RALPH STEVENS, JR. (Jun. '46), Designer, Stone & Webster Eng. Corp., 49 Federal St., Boston, Mass. (Res., 51 Liberty Park Ave., South Braintree, Mass.)

CARVER, DALE RINGWALT (Jun. '47), 1626 Laramie, Manhattan, Kans.

CASTLER, JOSEPH HARRY (Assoc. M. '46), Structural Engr. Designer, Ralph M. Parsons Co., Engrs., 411 West 5th St. (Res., 3424 Farmdale Ave.), Los Angeles 16, Calif.

CAUFIELD, WALLACE BURNSIDE (Assoc. M. '46), Dist. Representative, Caterpillar Tractor Co., Care, Export Dept., Peoria, Ill.

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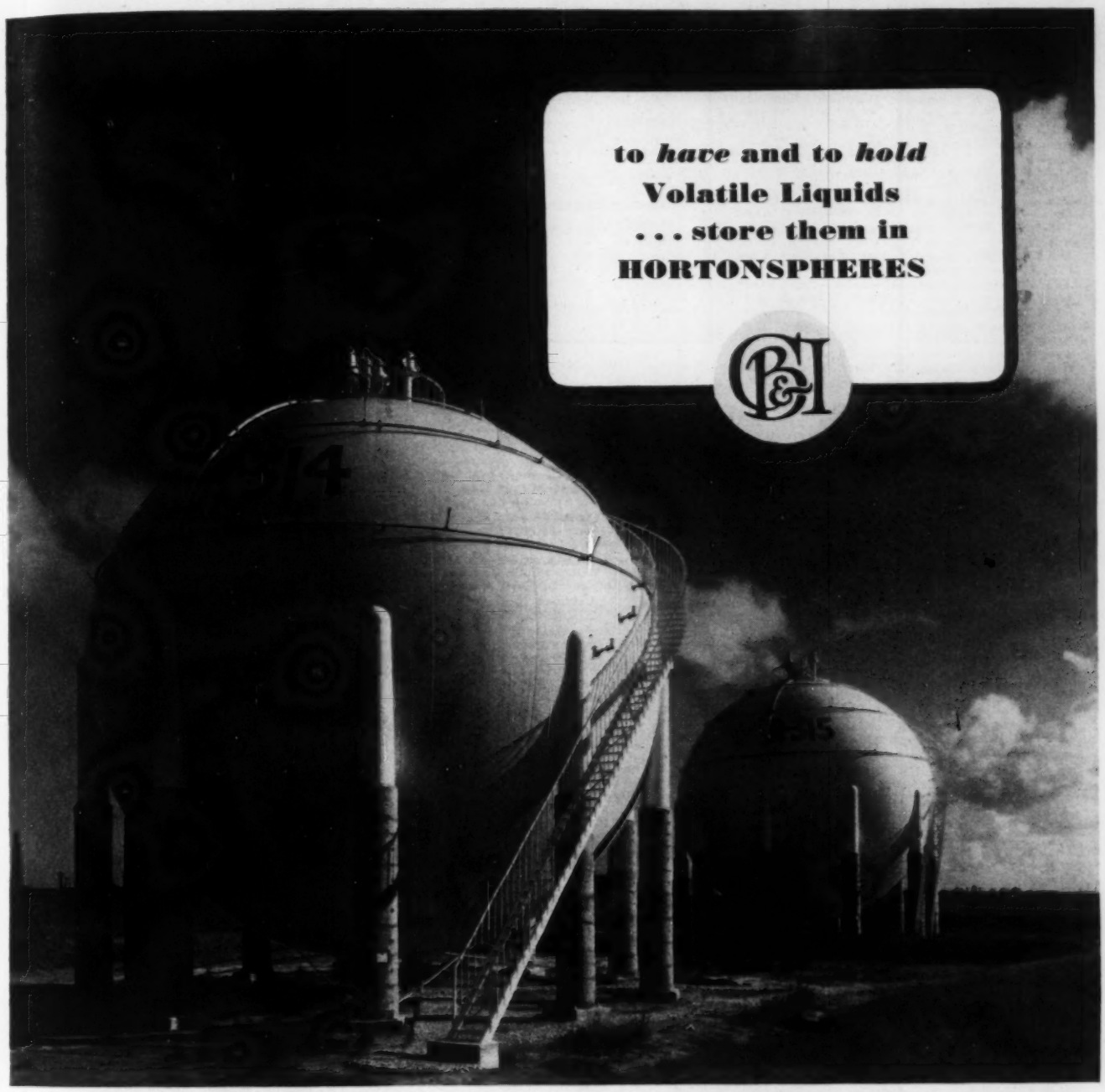

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(*Continued on page 82*)

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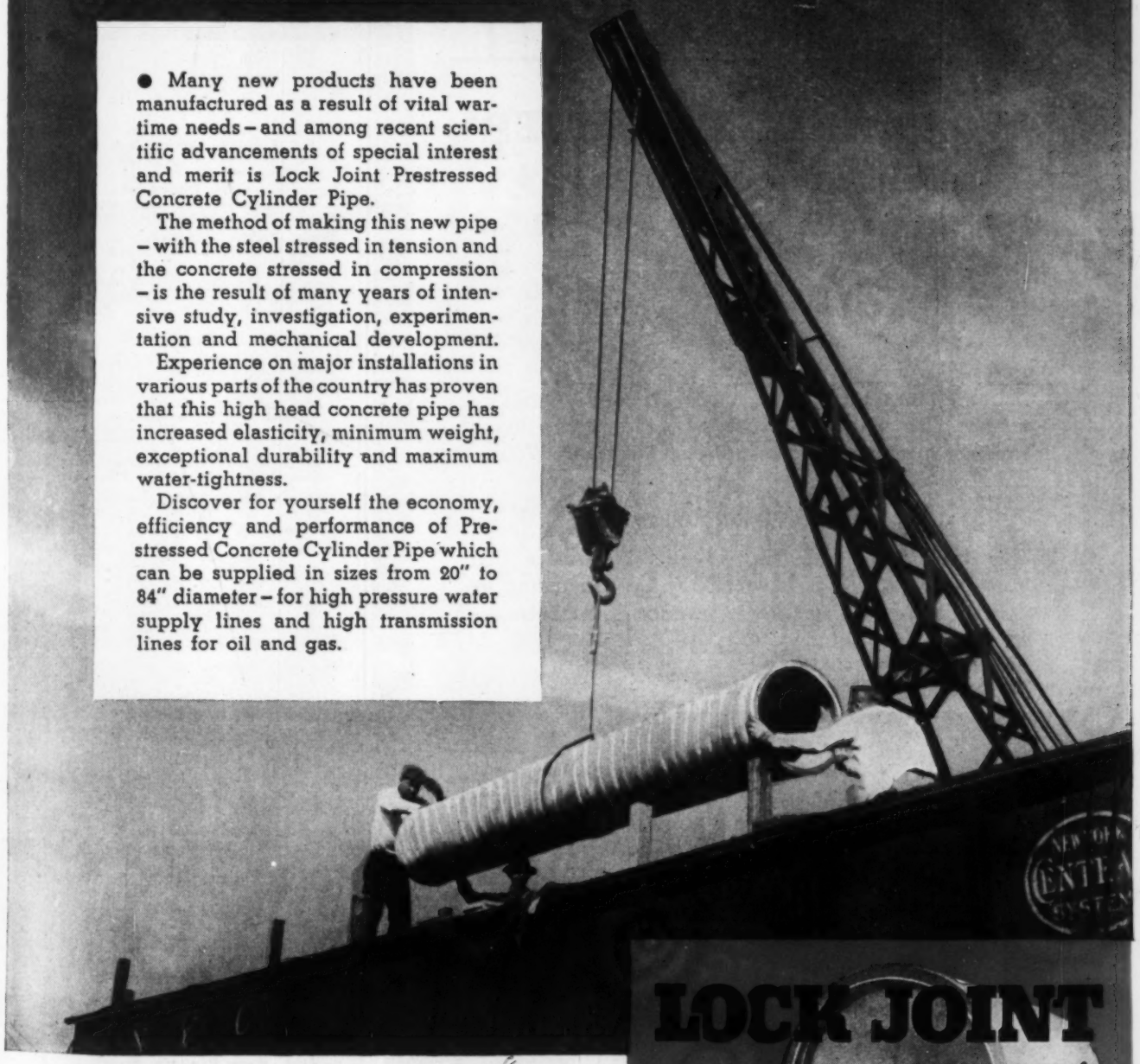

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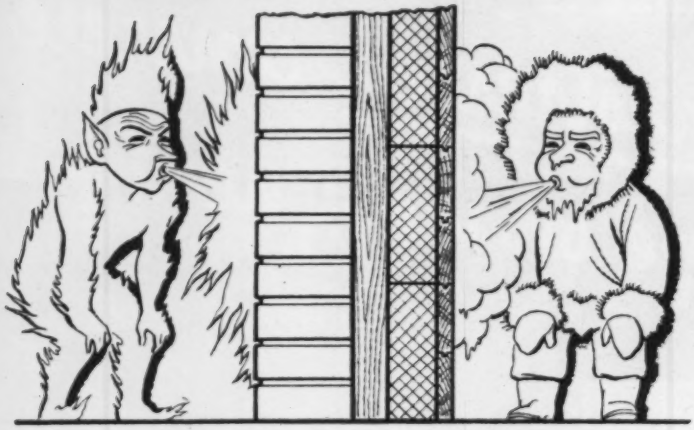

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REICHMANN, ALBERT FERDINAND, JR. (Jun. '36; Assoc. M. '46), Office Engr., Bates & Rogers Const. Corp., 111 West Washington St., Room 1741, Chicago, Ill.

REID, GRAEME (Assoc. M. '42; M. '47), Cons. Engr., Essex Fells, N.J.

RICH, CHARLES CARLYLE (Jun. '35; Assoc. M. '46), Dist. Engr., Soil Conservation Service, U.S.D.A., P.O. Box 116 (Res., 1321 Mountain Ave.), Santa Barbara, Calif.

ROBERTSON, DAN DUANE (Jun. '37; Assoc. M. '47), (Lindley Constr. Co.), 332 El Camino Real (Res., 42 Stockbridge Ave.), Atherton, Calif.

SAUER, VICTOR WOODROW (Jun. '35; Assoc. M. '46), Asst. Civ. Engr., Room 701 City Hall, Oakland 12, Calif.

SEEMAN, LYLE EDWARD (Jun. '34; Assoc. M. '39; M. '46), Col., Corps of Engrs., U.S. Army, War Dept., Adjutant General, Washington, D.C. (Res., 5907 North 18th St., Arlington, Va.)

SMITH, FREDERICK CHARNLEY (Assoc. M. '37; M. '47), Associate Prof. Civ. Eng., Univ. of Washington, Seattle, Wash.

SMITH, WALDO WOODROW (Jun. '39; Assoc. M. '46), Chf. Engr., Tower Iron Works, Box 1314 (50 Borden St.), Providence, R.I.

SPENCER, RAYMOND DANA (Jun. '28; Assoc. M. '30; M. '46), Engr., Koebig & Koebig, Cons. Engrs., Rowan Bldg., 5th and Spring, Los Angeles (Res., 1425 Bellwood Rd., San Marino), Calif.

SWANSON, FRANK ELMER (Jun. '34; Assoc. M. '47), Comdr., CEC, U.S.N. (Res., 1065 Bush St., San Francisco 9, Calif.)

QUADE, CHARLES OMAR (Jun. '28; Assoc. M. '40; M. '46), Eng. Associate, Tatum, Alexander & Quade, 2812 Fairmont, Dallas 4, Tex.

WALBRIDGE, SMITH STARR (Jun. '37; Assoc. M. '39; M. '46), Superv. Engr., W. Earle Andrews, 30 Rockefeller Plaza (Res., 1680 Metropolitan Ave.), New York 62, N.Y.

WALLACE, DONALD SANFORD (Assoc. M. '31; M. '47), Dist. Engr., U.S. Geological Survey, Box 1338, Univ. Station, Charlottesville, Va.

WEIGHT, WILLIAM KING (Jun. '36; Assoc. M. '46), Junior Civ. Engr., Dept. of Water and Power, City of Los Angeles (Res., Gen. Delivery, Independence), Calif.

WHITE, RUSSELL GRANT (Jun. '26; Assoc. M. '31; M. '46), 132 West Elmview Pl., San Antonio 2, Tex.

WILD, HARRY EDWARD (Jun. '39; Assoc. M. '47), Chf. Engr., Russell & Axon, Cons. Engrs., Inc., P.O. Box 1431 (Res., 421 Wisteria Rd.), Daytona Beach, Fla.

WOLPERT OTTO (Assoc. M. '16; M. '47), Senior Engr., in Chg. of Estimating Dept., Fisher Body Div., Works Eng., Gen. Motors Bldg. (Res., 121 Blaine Ave:), Detroit 2, Mich.

Reinstatements

ANDERSON, ARVAL LLOYD, Assoc. M., Asst. Regional Forester, U.S. Forest Service, Ogden, Utah, reinstated Jan. 8, 1947.

ANDERSON, IRVING ELMER, Assoc. M., Associate Engr., Water Resources Branch, U.S. Geological Survey, P.O. Box 2052, Jackson 115, Miss., reinstated Jan. 21, 1947.

BROADHURST, EDWARD MARQUETTE, Assoc. M., Asst. Engr., Gen., U.S. Engr. Dept., 575 Riverside Ave. (Res., 2056 Post St.), Jacksonville, Fla., readmitted Dec. 16, 1946.

BURRELL, GENE NATHANIEL, M., Hydr. Engr. Head, Special Hydr. and Sedimentation Study Section, U.S. Engr. Office (Res., 1612 Tremont St.), Galveston, Tex., reinstated Jan. 13, 1947.

CUMMINGS, WARREN GEORGE, Jun., 84-12 Thirty-fifth Ave., Jackson Heights, N.Y., reinstated Jan. 24, 1947.

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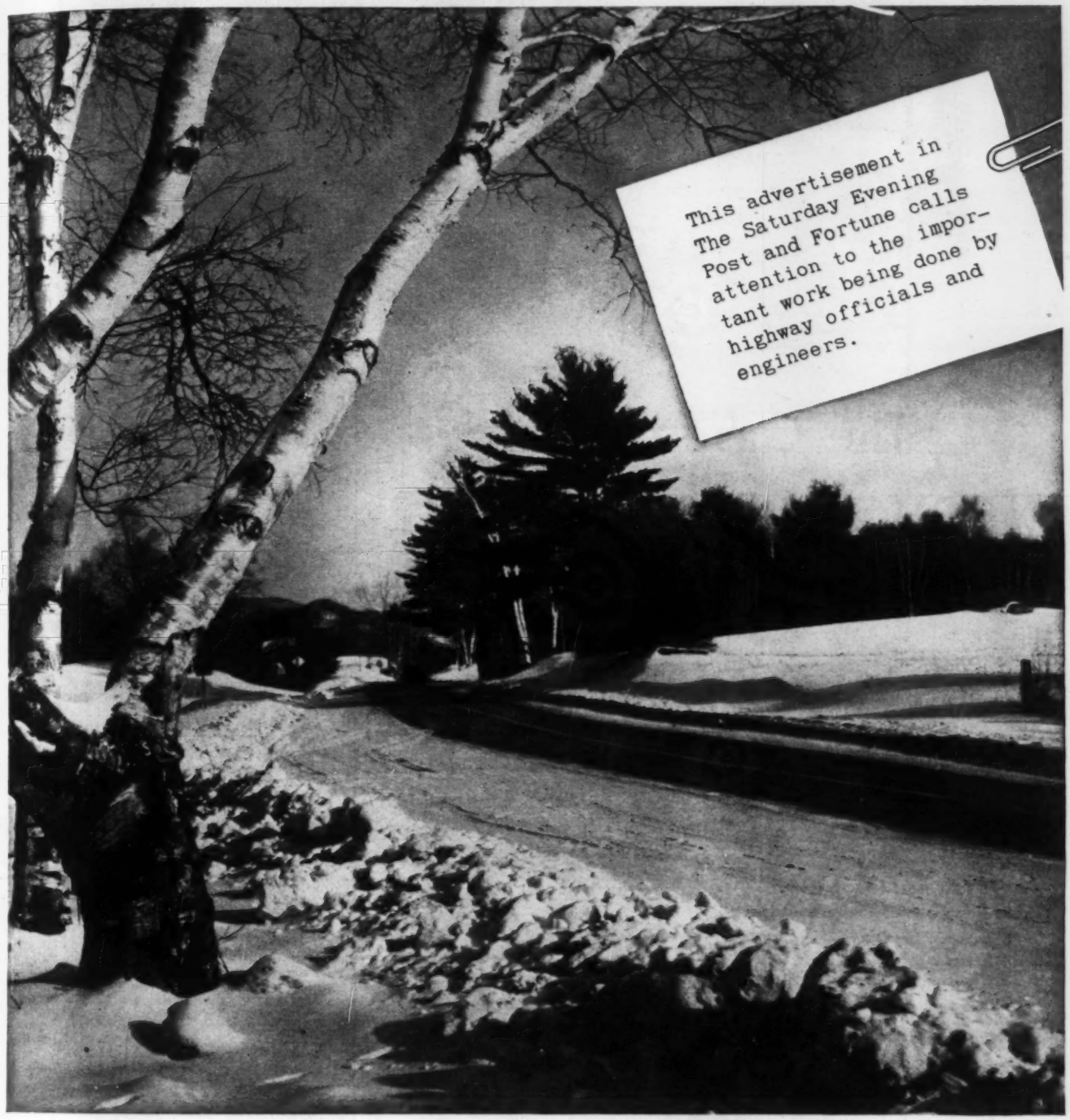

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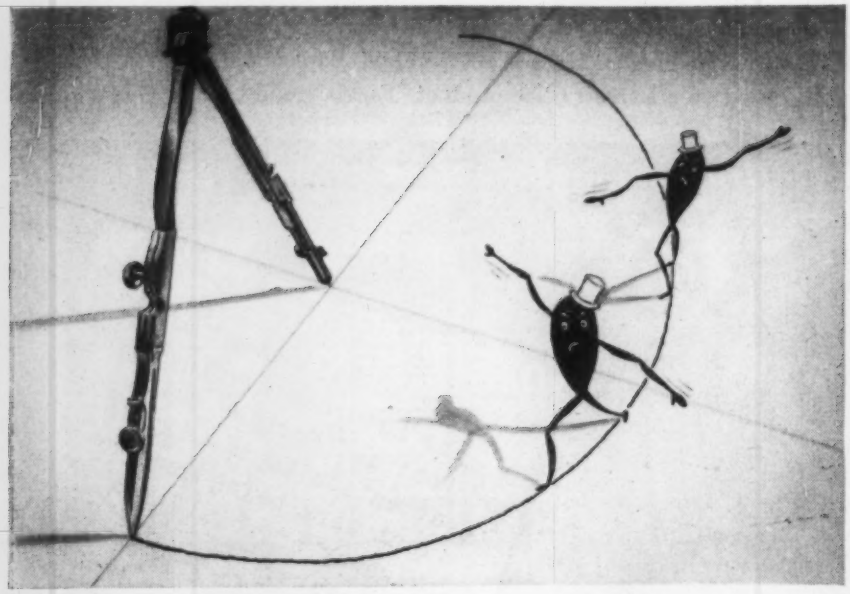

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GARDNER, ROBERT ANTHONY, Assoc. M., 746 Main St., Peckville, Pa., reinstated Jan. 13, 1947.

KRULL, ROBERT ALWIN, Jun., 1341 Lincoln St., Hobart, Ind., reinstated Jan. 20, 1947.

LEE, ZUR-DAU, Jun., Care, Bureau of Public Works, Sewerage and Drainage Dept., Shanghai Municipal Govt., 103 Kiukiang Road, 2d Floor, Shanghai, China, reinstated Jan. 7, 1947.

MACCHI, ANSELMO JOHN, Jun., Structural Engr., 607 Main St., Hartford, Conn., reinstated Jan. 8, 1947.

MACKICHAN, KENNETH ALLEN, Assoc. M., Associate Engr., U.S. Geological Survey, 408 Union Bldg., Charleston 1, W.Va., readmitted Jan. 13, 1947.

MACNAMEE, DANIEL FRANCIS, M., Pres., Daniel F. MacNamee & Co., Inc., 271 North Ave., New Rochelle, N.Y., readmitted Jan. 13, 1947.

NEELY, MARVIN YOUNG, Assoc. M., Capt., CEC, U.S.N., 90 Church St., New York, N.Y., reinstated Jan. 8, 1947.

REYES, RAFAEL, Assoc. M., Associate Engr., Puerto Rico Water Resources Authority, San Juan, Puerto Rico, readmitted Dec. 16, 1946.

ROBERTS, LEO BOND, M., 717 Barnett St., Kerrville, Tex., reinstated Jan. 20, 1947.

SMALL, GILBERT, Assoc. M. (Gilbert Small & Co., Inc.), 10 State St., Boston 9, Mass., reinstated Jan. 9, 1947.

STEVENS, WILLIAM GEORGE, JR., Assoc. M., Cons. Engr., 1500 Walnut St., Suite 2100 (Res., 5412 Kingsessing Ave.), Philadelphia 43, Pa., readmitted Dec. 16, 1946.

THOMPSON, HARRY WARREN, M., Engr. (P-7), Chf., Engr. Div., U.S. Engr. Office, Los Angeles, 751 South Figueroa St., Los Angeles, Calif., readmitted Dec. 16, 1946.

Resignations

BURGESS, HAROLD THOMAS, M., 201 Fourth St., Meriden, Conn., resigned Jan. 14, 1947.

CRAWFORD, CLARK ALVIN, Jun., 209 Sharwill Place, Corning, N.Y., resigned Jan. 20, 1947.

DAWSON, JAY BOSWORTH, M., 3rd and Townsend Station, San Francisco 7, Calif., resigned Jan. 15, 1947.

FRAENKEL, STEPHEN JOSEPH, Jun., 455 Melrose St., Chicago 13, Ill., resigned Dec. 31, 1946.

GARRISON, GERALD RAY, Jun., Vashon, Wash., resigned Jan. 20, 1947.

GLASSMIRE, HARRY MARTIN, M., 36 Montrose Ave., Buffalo 14, N.Y., resigned Jan. 21, 1947.

GROTE, ALBERT OTTO, Jun., 2215 Olympic Blvd., Montebello, Calif., resigned Jan. 24, 1947.

HICKS, JAMES MOYER, Assoc. M., 2950 Corydon Rd., Cleveland Heights 18, Ohio, resigned Jan. 7, 1947.

HICKS, NEWTON FRANKLIN, Jun., 1383 Kelton Ave., Los Angeles 24, Calif., resigned Jan. 22, 1947.

HILL, WILLARD ALVIN, Assoc. M., 2154 Maplewood Ave., Toledo 6, Ohio, resigned Jan. 7, 1947.

HORTON, KENT HOWARD, Jun., 229 Regent St., Hampton, Va., resigned Jan. 21, 1947.

HOWALT, WILHELM M., 197 Summer St., Buffalo 9, N.Y., resigned Jan. 9, 1947.

IRELAND, CARROL BERT, M., 2615 L Ave., National City, Calif., resigned Jan. 6, 1947.

KIDD, GEORGE FREDERICK, M., 61 Hollywood Ave., East Orange, N.J., resigned Jan. 8, 1947.

MILLER, LAWRENCE CHARLES, Assoc. M., Gen. Delivery, Elsinore, Calif., resigned Jan. 9, 1947.

PENDLETON, THOMAS PERCY, M., 7605 Dellwood Place, Bethesda 14, Md., resigned Jan. 31, 1947.

POHLE, FREDERICK VALENTINE, Jun., Institute for Mathematics and Mechanics, 53 Washington Square South, New York 12, N.Y., resigned Jan. 7, 1947.

POUCHER, GEORGE EDWARD, M., 162 George St., Rochester, Pa., resigned Jan. 8, 1947.

RAPP, EDWARD GEORGE, Jun., 9 Jordan Dr., Willoughby, Ohio, resigned Jan. 3, 1947.

ROSSOW, CARL JOHN, Jun., 515 Plaza Bldg., Pittsburgh 19, Pa., resigned Jan. 13, 1947.

RUDE, GILBERT THOMAS, CAPT., M., 3900 Military Road, N.W., Washington, D.C., resigned Jan. 22, 1947.

SAUNDERS, EDWARD WATTS, M., Rocky Mount, Va., resigned Jan. 27, 1947.

SCHWENDIMAN, GLENN, Jun., 525½ East Wyandotte St., Freeport, Ill., resigned Jan. 21, 1947.

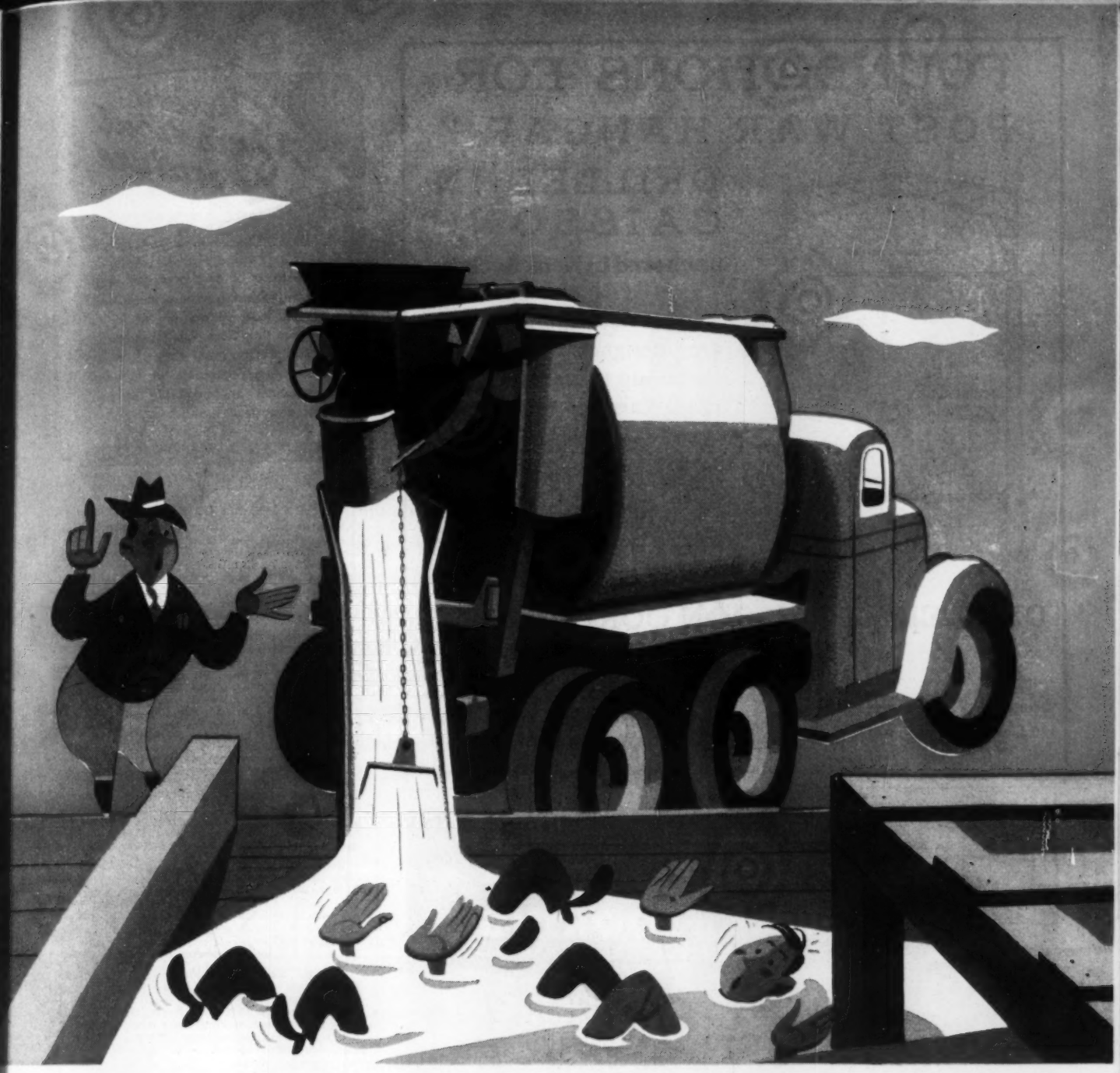
SONNICHSEN, JOHN CHRISTIAN, Jun., Route 1, Box 370, Orting, Wash., resigned Jan. 21, 1947.

SPEERS, WILLIAM EWING, JR., Jun., 65 Plymouth St., Montclair, N.J., resigned Jan. 8, 1947.

TOMASSETTI, BENJAMIN GABRIEL, Jun., Saint Fidelis Seminary, Herman, Pa., resigned Jan. 6, 1947.

URBAN, WILLIAM JOHN, Assoc. M., 4509 West Melvina St., Milwaukee 10, Wis., resigned Jan. 21, 1947.

WESTFALL, MILLARD FRANK, Jun., 2152 South Owasso, Tulsa 5, Okla., resigned Jan. 20, 1947.



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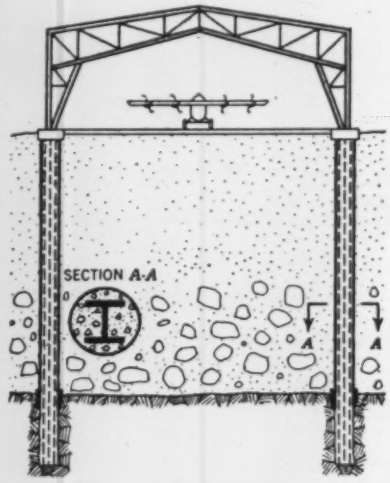

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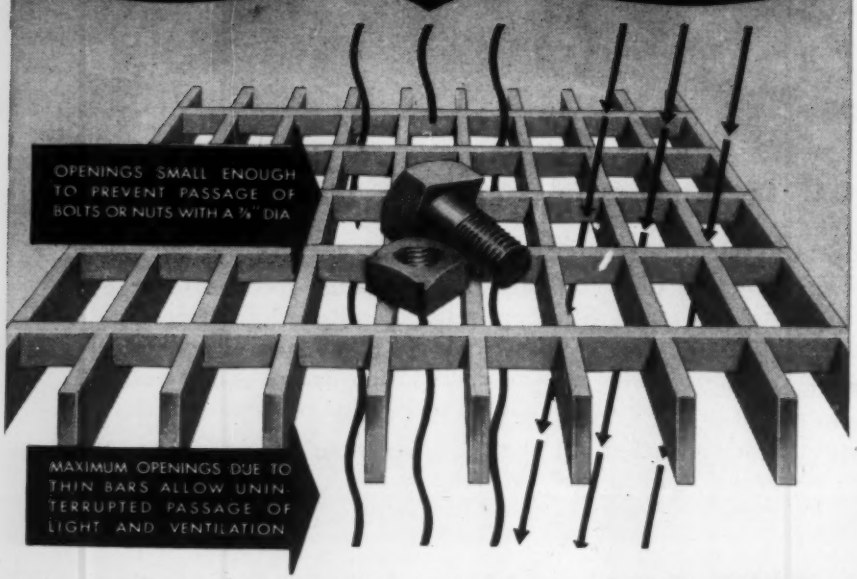
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BRIDGES

CONSTRUCTION, MILITARY ENGINEERING. Rhine Crossing, Rees, 23rd March, 1945, F. C. Nottingham. *Roy. Engrs. J.*, vol. 40, Sept. 1946, pp. 250–253, 2 supp. plates. Brief description of bridges and sites of ferries built by Royal Engineers during assault crossing of River Rhine near Rees. Table presents data on type of bridges, length, construction duration, and equipment.

HIGHWAY. Principles and Techniques of Highway Bridge Surveys, H. L. Doten. *Maine Univ.—Technology Experiment Station—Bul. no. 41*, June 1946, 50 pp. Discussion of organization of survey aimed at obtaining complete data to serve as basis for location and design of highway bridges. Data on equipment, procedure, field notes, stream bed, adjacent terrain, conditions of foundation, provisions for traffic, and material.

HIGHWAY, MAINTENANCE AND REPAIR. Bridge Inspection Procedures and Bridge Maintenance. *Pub. Works*, vol. 77, no. 7, July 1946, pp. 22–24. Discussion of procedure of bridge inspection covering waterways, piers and abutments, structure, and special features; description of method of cutting and placing stringers. Data based on manuals of various state highway departments.

STEEL, CALIFORNIA. Peach Bowl Laced by New Bridge, H. W. Hutchinson. *Calif. Highways & Pub. Works*, vol. 24, nos. 9–10, Sept.-Oct. 1946, pp. 22–24. Obsolete bridge over Feather River between Marysville and Yuba City, Calif., is being replaced by steel structure that will provide four-lane highway. It consists of 24 spans from 115 to 161 ft long supported by concrete piers.

STEEL, KENTUCKY. High-Level Kentucky Span Open to Traffic. *Better Roads*, vol. 16, no. 9, Sept. 1946, p. 26. Brief description of highway bridge at Clay's Ferry, Ky. With its deck 250 ft above normal river level, it is highest bridge east of Mississippi River. Continuous steel-deck structure has total length of 1,736 ft.

STEEL TRUSS, TEMPORARY. Modified Bailey Bridge Trusses Provide Temporary River Crossing. G. H. Allen. *Eng. News-Rec.*, vol. 137, no. 12, Sept. 19, 1946, pp. 368–369. Eight lines of Bailey Bridge trusses were assembled on shore in two sections, swung into position with shore-based guy derrick and decked with timber to provide 100-ft span, two-lane highway bridge over Patoka River in southwestern Indiana. Bridge was completed in 48 days to serve as temporary crossing, following collapse of 68-year-old pin-connected truss bridge.

BUILDINGS

RESEARCH LABORATORIES. Naval Testing Lab. in Desert, A. E. Niederhoff. *Western Construction News*, vol. 21, no. 9, Sept. 1946, pp. 89–91. Illustrated description of dustproof, sparkproof, and earthquake-resistant laboratory, erected by Navy 10 miles east of Bakersfield, Calif., to house $5,000,000 guided-missiles research laboratory. Details of steel reinforcement, pumice concrete, precast louvers, and prefabricated roof shoring.

CITY AND REGIONAL PLANNING

FAIRBANKS, ALASKA. Fairbanks—"Chicago of Alaska"—Has Some Ambitious Construction Plans, A. E. Niederhoff. *Pac. Bldr. & Engr.*, vol. 52, no. 9, Sept. 1946, pp. 62, 64, and 68. General remarks on Fairbanks, Alaska, as tourist center, and on plans to make it attractive, business-like, and cultural. Plans discussed include water supply, schools and civic center, sewer extensions, fire station and street improvements.

GREAT BRITAIN. Planning and Reconstruction in Coventry, A. R. Pugh and A. L. Percy. *Instn. Mun. & County Engrs.—J.*, vol. 73, no. 2, Sept. 1946, pp. 73–92 (discussion) 93–99. Data on development of Coventry, England, from 1801

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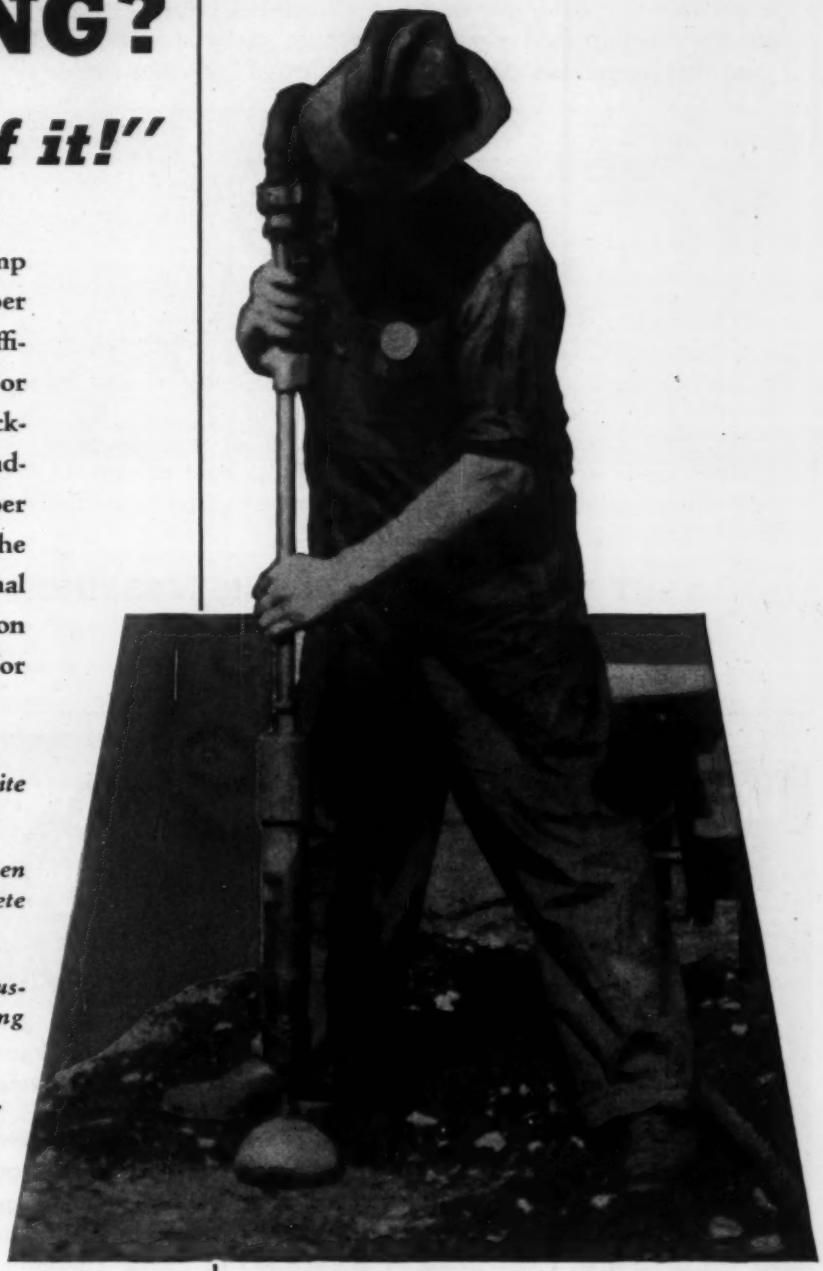

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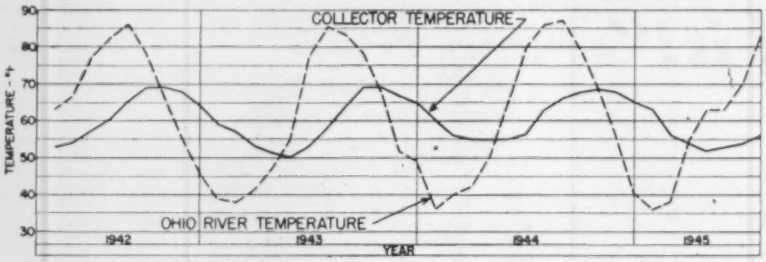

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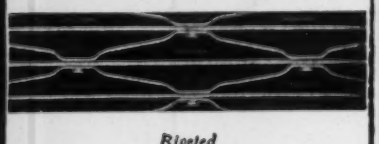

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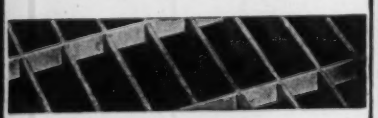

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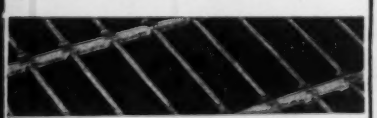

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INDUSTRIAL PLANTS, DECENTRALIZATION. Research Moves to Country, R. Walker. *Am. City*, vol. 61, no. 9, Sept. 1946, pp. 103–104. Discussion of considerations to be given to choice of site used for factory. Movement of non-nuisance industry to country sites is caused by same factors that bring about decentralization of population. Examples for industrial research laboratories in rural surroundings; suggestions for benefit of prospective buyers of sites.

NETHERLANDS. Plan for Rotterdam, E. Draper, Jr. *Arch. Rec.*, vol. 100, no. 4, Oct. 1946, pp. 72–77. Illustrated description of reconstruction plan of Rotterdam, which seeks to achieve orderly grouping of related functions.

PROGRESS IN PLANNING. 20 Years Show Marked Improvement in Planning. *Am. Bldr. & Bldg. Age*, vol. 69, no. 10, Oct. 1946, pp. 92–93. Community plan typical of gridiron pattern common in 1926, and "curvilinear pattern" of today are discussed to show progress in planning.

SHOPPING CENTERS. Unique Shopping Center Proposed. *Am. City*, vol. 61, no. 9, Sept. 1946, p. 117. Brief description of planned shopping center in Flushing, N.Y., covering approximately 25 acres of land, with overhead parking, moving sidewalks, day nurseries, theater and entertainment area, hotel, and bus terminal.

CONCRETE

AIR ENTRAINMENT. Air-Entraining Portland Cement, C. L. Davis. *Arch. Rec.*, vol. 100, no. 4, Oct. 1946, pp. 126–127. Data on workability and durability of air-entrained portland cement; discussion of concrete mixtures, specifications, and applications; report on tests.

COLUMNS, STRESSES. Reinforced Concrete Columns Under Combined Compression and Bending, H. E. Wessman. *Am. Concrete Inst.—J.*, vol. 18, no. 1, Sept. 1946, pp. 1–8. New method of analysis of reinforced concrete columns subject to combined compression and bending. Key of method is reciprocal relationship between load axis and neutral axis of transformed section; theory is applied to typical examples.

CONCRETE PRODUCTS PLANTS, MISSOURI. Combine Ready-Mix and Concrete Block Operations, M. E. Swanson. *Rock Products*, vol. 49, no. 10, Oct. 1946, pp. 151–152. Uniform mix, both for concrete products and ready mixed concrete, is feature of plant at Cape Girardeau, Mo. Data on bucket elevator, aggregate bins, traveling batcher, and conveyors.

CONSTRUCTION, FORMS. Collapsible Steel Forms Build Hollow-Wall Concrete Houses, *Construction Methods*, vol. 28, no. 10, Oct. 1946, pp. 88–90. Illustrated description of movable steel form for hollow concrete wall; it can be released by raising handle and moved by three men to next section. Details of construction.

DAMS

CONCRETE GRAVITY, CONNECTICUT. Comments on Construction of Saugatuck Dam, S. P. Senior, *New England Water Works Assn.—J.*, vol. 60, no. 3, Sept. 1946, pp. 266–268. Brief description of construction of 126-ft-high concrete gravity Saugatuck Dam about 12 miles northwest of Bridgeport, Conn. Data on concrete aggregates, mixing, and construction costs.

CONCRETE GRAVITY, CONNECTICUT. Construction of Norwalk Lake Dam, J. E. Riordan, *New England Water Works Assn.—J.*, vol. 60, no. 3, Sept. 1946, pp. 255–265. Description of concrete gravity dam, on Silvermine River at New Canaan, Conn., now under construction. Overall length 1,012 ft; height above bedrock 105 ft. Data on spillway, inlet and outlet works, excavation, stream diversion, cofferdams and concrete mixing.

EARTH, ARIZONA. Preliminary Work Gets Under Way at Davis Dam. *Construction Methods*, vol. 28, no. 10, Oct. 1946, pp. 98–99. General remarks on construction of Davis Dam, Ariz. First step, now under way, is excavation of diversion and forebay channel; next is concrete lining of latter; third is diversion of Colorado River. Capacity of reservoir will amount to 1,750,000 acre-ft.

RESERVOIRS, MULTIPLE PURPOSE. Cooling Water Benefits from Increased River Flows, M. LeBosquet, Jr. *New England Water Works Assn.—J.*, vol. 60, no. 2, June 1946, pp. 111–116. Reservoirs built for purpose of storing flood waters may also be used for industrial cooling water. Temperature formula is developed and applied to determination of effect of increased flow on pollution conditions in streams used for cooling purposes.

SPILLWAYS, MODEL TESTING. Spillway-Gate Operation to Prevent Erosion Below Dams, A. Lentz. *Modern Power & Eng.*, vol. 40, no. 10, Oct. 1946, pp. 66–69. Results of model tests made at Univ. of Wisconsin Hydraulic Laboratory, indicating that manner of operation of spillway gates can be major factor in amount of scour to be expected on foundations, which vary from "solid rock" to fine sand. Spreading flow across face of spillway section of dam materially reduced erosive force of water.

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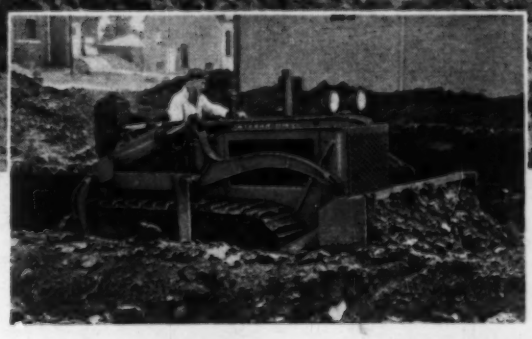

You can see for yourself in these photographs how the International TD-14 with a bulldozer blade gets on with a basement digging job. Here the average distance from cut to spoil was 60 feet, depth to dig was 6 feet, yardage dug was 420 cubic yards of clay. Total time required was 6½ hours.

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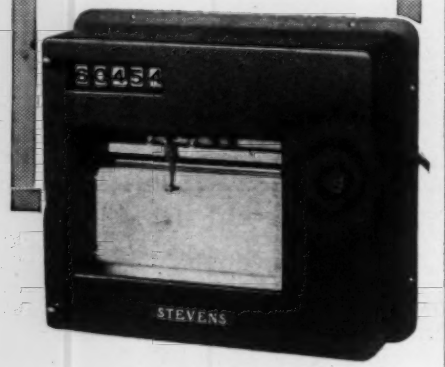

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FLOOD CONTROL

CALIFORNIA. Flood Flows and Stages in Sacramento and Northern San Joaquin Valleys. *Calif. Dept. Pub. Works—Div. Water Resources—Report*, Aug. 1946, 192 pp., 2 supp. plates. Information for 33-year period from Oct. 1913 to May 1946 on 109 stream-gaging stations used for making flood stage or magnitude measurements and data on daily mean and crest flood flows and stages at those stations, together with account of functioning of Sacramento River Flood Control Project between fall of 1944 and spring of 1946.

IRRIGATION

CUBA. Planning Cuban Irrigation Projects, Ramiro Guerra y Deben. *Sugar*, vol. 41, no. 10, Oct. 1946, pp. 29–31. Proper estimate of irrigation requirements, advantages of sugar-cane irrigation, requirements pertaining to topography and to waterworks, pump vs. gravity systems, permeability and drainage.

OVERHEAD. Aluminum Used in Irrigation System, R. B. Whidden. *Western Construction News*, vol. 21, no. 6, June 1946, pp. 104–105. Use of aluminum tubing employed in surface pipe irrigation systems described. It does not erode soil, is portable and easy to install.

LAND RECLAMATION AND DRAINAGE

BULKHEADS. Concrete Bulkheads for Outlet Protection, W. S. Lynes. *Agric. Eng.*, vol. 27, no. 10, Oct. 1946, pp. 459–460. In survey of drainage systems in Webster County, Iowa, 31 concrete bulkheads were examined, all failures; other outlets, inexpensively made by using corrugated galvanized pipe, were still serving efficiently. Principal reasons for failure of concrete structures, design considerations.

FLORIDA. Artificial Recharge of Artesian Limestone at Orlando, Fla., A. G. Unklesbay and H. H. Cooper, Jr. *Economic Geology*, vol. 41, no. 4, June-July 1946, pp. 293–307. Principal aquifer in Orlando area consists of 900 ft or more of permeable artesian limestones, into which more than 200 wells have been drilled to drain streets, control lake levels, and dispose of sewage. Most of wells have large capacities for receiving water and seldom become clogged.

ROADS AND STREETS

AIRPORT RUNWAYS. Vibrators and Finisher, for Thick Runway Slabs. *Construction Methods*, vol. 28, no. 10, Oct. 1946, pp. 84–85. Illustrations and description of heavy vibrating equipment and finishers used for 18-in. thick concrete pavement at Fairfield-Suisun, Calif., Army airbase.

AIRPORTS, INDIA. Airfield Construction in India, A. W. H. Dean. *Instn. Engrs. India—J.*, vol. 26, no. 3, Mar. 1946, pp. 112–121. General remarks on airfield construction in India with particular reference to war conditions. Data on choice of site, layout, construction, runways, and specifications.

CALIFORNIA. Rosemead Boulevard Job Completed. *Calif. Highways & Pub. Works*, vol. 24, nos. 9–10, Sept.-Oct. 1946, pp. 26–28. Recently completed one-mile section of Rosemead Boulevard east of Pasadena, Calif., is built of cement-treated soils and base. Both road-mix method and central-mixing plant were used. Final surface is 4 in. of asphaltic concrete. Illustrated description of job and equipment.

SEWERAGE AND SEWAGE DISPOSAL

INDUSTRIAL WASTES. Industrial Waste Treatment and Disposal, F. G. Nelson. *Pac. Bldr. & Engr.*, vol. 52, no. 9, Sept. 1946, pp. 80–81. Discussion of treatment of industrial waste. Screening considered minimum requirement; principle of vacuum flotation, problem of sludge disposal, trickling filters and methods of chemical precipitation; ponding and lagooning reviewed. Before Pacific Northwest Sewage Works Assn.

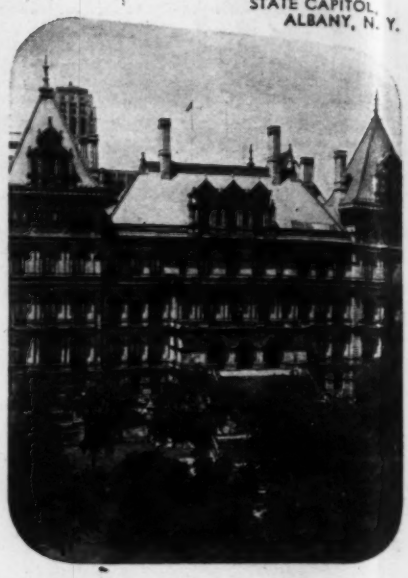
SAN FRANCISCO, CALIF. San Francisco Enlarges Richmond-Sunset Sewage Treatment Plant, S. P. Duckel. *Am. City*, vol. 59, no. 7, July 1946, pp. 103–104. Illustrated report on plans and specifications for enlargement of plant; capacity will be increased to 20 mgd. New development for washing primary sludge before it is discharged into secondary digester will be used.

SEWAGE FILTERS. Vacuum Filtration at York Township, E. H. Munroe. *Water & Sewage*, vol. 84, no. 9, Sept. 1946, pp. 36, 53–54. Illustrated description of operation at York Township sewage plant, Ont., with particular reference to rotary continuous-type filters. Tests made in effort to reduce ferric chloride gave promising results with diatomaceous earth and ferric chloride. Range of 24 to 26 in. of vacuum proved most effective gage of proper dosage.

SEWAGE TANKS, DESIGN. English Design of Sedimentation Tanks, L. B. Escritt. *Sewage Works Eng.*, vol. 17, no. 9, Sept. 1946, pp. 459–461. Study of sedimentation-tank design considering inlets, outlets, tank proportions, currents in tanks, sludge pipes, scum removal, washouts, and channels.

SEWAGE TREATMENT. Why Does Sewage Treatment Lag? R. E. Thompson. *Water & Sewage*, vol. 84, no. 9, Sept. 1946, pp. 30, 48–49.

STATE CAPITOL
ALBANY, N. Y.



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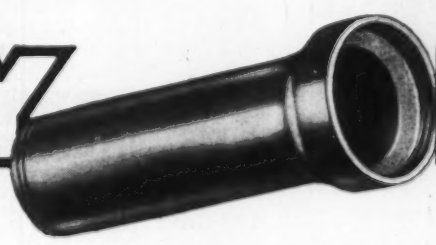
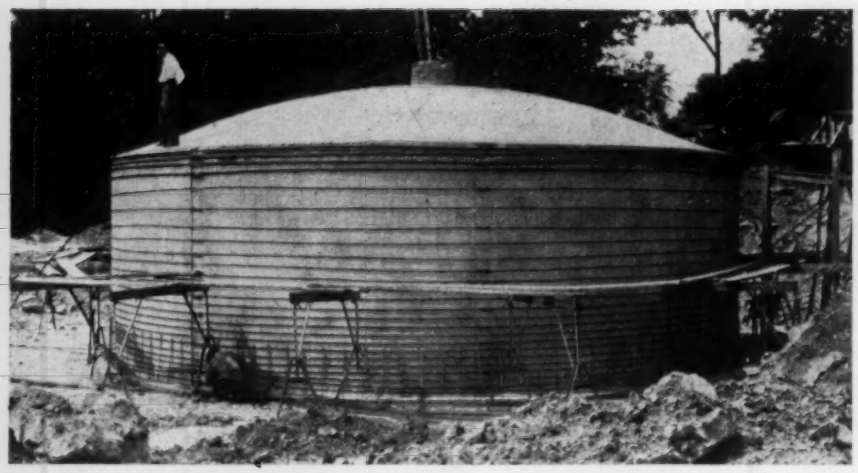
CLAY  PIPE



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Prevention of water-borne diseases by effective water treatment. Sewage-treatment facilities have not kept pace with adoption of water purification. Discussion of reasons for lag in sewage treatment, with particular consideration of industrial wastes. Bibliography.

SEWERS, INFILTRATION. Infiltration Into Sewers. *Pub. Works*, vol. 77, no. 7, July 1946, pp. 25 and 36. Problem of infiltration of ground water or entrance of stormwater into sewers is discussed on basis of answers given by city engineers to questionnaire sent out by editors of *Public Works*.

TREATMENT PLANTS, BILOXI, MISS. Biloxi's Wartime Sewage Treatment Plant. *Am. City*, vol. *61*, no. 9, Sept. 1946, pp. 105–106. Illustrated description of sewage treatment plant built during wartime to meet requirements of fast growing town; data on digestion tanks, trickling filters, primary and final tank.

TREATMENT PLANTS, KLAMATH FALLS, ORE. Variable Load Causes Trouble at Naval Air Station, J. P. McCormack. *Sewage Works Eng.*, vol. 17, no. 9, Sept. 1946, pp. 461–462. Sudden drop in sewage discharge into treatment plant at Klamath Falls, Ore., Naval Air Station created problems at end of war. It is now hardly possible to get enough solids into aerators to keep them properly operating, or to produce enough gas to keep boiler going, owing to insufficient sludge, and major problem is what to do with supernatant liquor.

TREATMENT PLANTS, ONTARIO. Sewage Treatment in Canada, A. E. Berry. *Water & Sewage*, vol. 84, no. 9, Sept. 1946, pp. 26–28, 57–58. General description of sewage treatment in Canada with particular reference to practices in Greater Toronto. Canadian practice is not unlike that in United States owing to similar standards of pollution, legislation, and engineering. Data on Toronto's plant now under construction.

STRUCTURAL ENGINEERING

BUILDING MATERIALS, EARTH. Walls of Rammed Earth in New House, N. R. Love. *Western Construction News*, vol. 21, no. 6, June 1946, p. 99. Illustrated description of construction of "monolithic stabilized gravel" for single-story dwelling units, utilizing adjacent soil with rather high clay content; 6-in. layers of material are compacted to approximately 4 in. with pneumatic backfill tampers. Wall thickness of 16 in. has been found satisfactory.

HIGHWAY, STRESSES. Maximum Bridge Load. *Western Construction News*, vol. 21, no. 9, Sept. 1946, pp. 104–105. Chart for quick determination of maximum moment and maximum reaction for highway bridges of 4-ft to 100-ft span under various loadings. Values of chart are for one full lane width, simple spans, no impact.

WALLS. Better Wall Is Coming, R. L. Davison. *Arch. Rec.*, vol. 100, no. 4, Oct. 1946, pp. 119–123. Data on new wall materials having structural strength, low heat transmission, good acoustic properties and resistance to wear; discussion of metal panels and appearance. Improvement of building codes is suggested.

TRAFFIC CONTROL

PORTLAND, ORE. How Movement of Traffic in Portland Will Be Expedited by Interchanges, R. H. Baldock. *Pac. Bldr. & Eng.*, vol. 52, no. 9, Sept. 1946, pp. 35–38. Pacific Highway (Route 99) leads directly into and through business section of Portland. To overcome traffic congestion, interchanges will divert local traffic and expedite flow of through traffic. Project estimated at $3,000,000 calls for tunnels, bridges and railroad crossings as well as arterial highway. Plans of general route and interchange shown.

TUNNELS

CONSTRUCTION, LINING. Two Million Lining Bolts, S. Jones. *Fasteners*, vol. 3, no. 3, 1946, pp. 14–16. Steel bolting applications in linings of Hudson River tunnels of Hudson & Manhattan RR Co.; lining construction and bolting procedure; bolt performance record.

SUBWAY CONSTRUCTION, SOVIET UNION. Modern Tunnelling on Moscow's Fourth Subway. *Construction Methods*, vol. 28, no. 9, Sept. 1946, pp. 108–109. Illustrated report on fully mechanized methods in driving section of Moscow subway. Operations include use of hydraulic-drive shield, pneumatic clay spades, automatic feed drifter drills, air-driven mine-type mucking machines, and electric haulage and hoisting.

WATER PIPE LINES

CONSTRUCTION. Concrete Pipe Jacked Under Railroad. *Eng. News-Rec.*, vol. 137, no. 10, Sept. 5, 1946, pp. 299–301. Illustrated description of hydraulic jacking of 75 ft of 48-in. reinforced concrete pipe beneath Pennsylvania Railroad tracks in Chicago, Ill.; data on equipment and procedure. Pipe will serve as conduit and access tunnel to carry 8-in. water line and 18-in. cast-iron sewer.

LITTLE ROCK, ARK. Little Rock, Ark., Extends Water Distribution System, L. A. Jackson. *Am. City*, vol. 61, no. 9, Sept. 1946, p. 121. Increase in population of Little Rock from 7,948 in 1916 to 21,890 in 1946 necessitated installation of new water main, and improvement of pressure and flow conditions.

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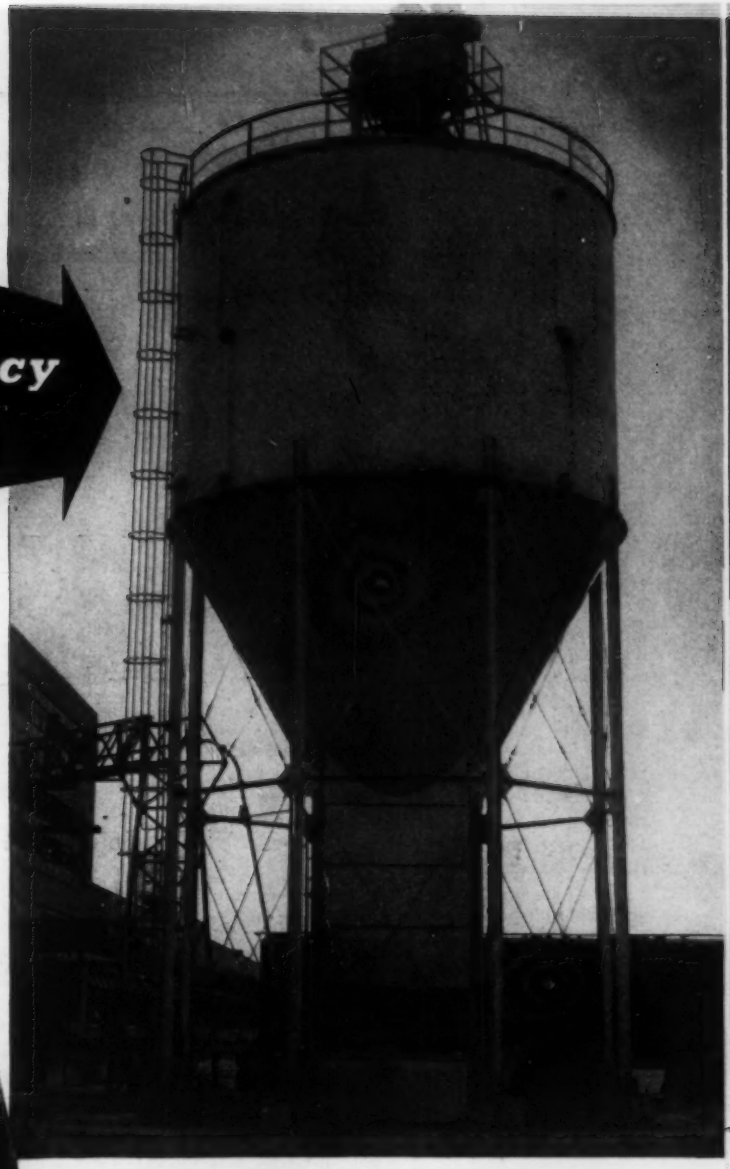

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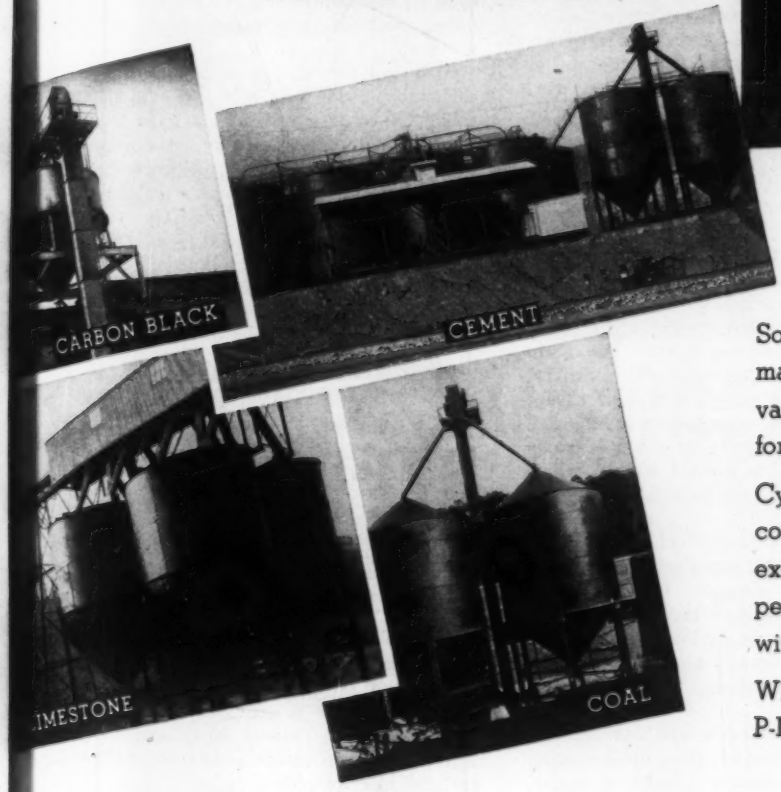

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Equipment, Materials and Methods

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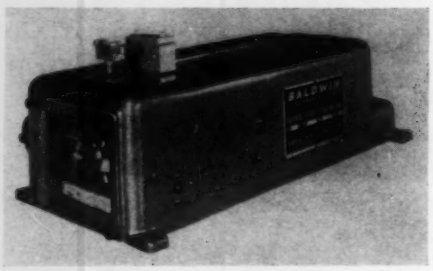
Bulletin 256, describing the machine in detail, can be obtained from The Baldwin Locomotive Works, Philadelphia 42, Pa.



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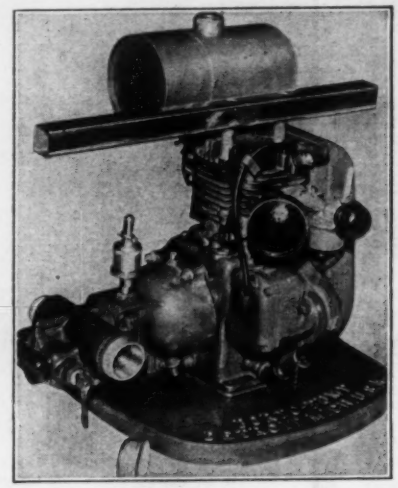


Small High-Pressure Pump

A scientifically designed, high-pressure utility pump is being manufactured by Porto-Pump, Inc., Detroit, Mich. Porto-Pump was developed in cooperation with forestry men for combating forest fires. It has since been adapted for jetting by bridge and dock contractors, testing water mains, placer mining, and oil well survey. Where hydrants are not available, water from any ditch, lake or cistern can be used as the rubber impellers are not affected by dirty water.

On accredited flow-meter tests Porto-Pump delivers in excess of 43 gallons per minute at 100 lb pressure; over 40 gallons per minute at 120 lb pressure and has a suction lift of 31 ft. The unit is set for a maximum pressure of 165 lb per sq in.

The self-contained power source is a single-cylinder, four-cycle engine, air cooled and delivering 5 hp. The main bearings are of the taper-roller variety, assuring smooth power flow and exceptionally long life. The pump is mounted directly to the engine and power is transmitted through a splined sleeve, which absorbs shock and serves as a self-aligning coupling.

An important feature of Porto-Pump is the use of rubber impellers, which virtually eliminate abrasion by dirt particles. These impellers expand longitudinally under pressure, preventing water loss by leakage due to end play, and thus assuring high volume and consistent pressure.

The by-pass valve is still another feature of Porto-Pump. It facilitates starting the pump against a head of water. The valve is actuated by a small lever near the outboard bearing end of the pump. When in the open position, it allows circulation of water within the pump, which at once relieves back pressure. The open valve lowers pressure, as desired, to a point near zero, permitting change of nozzle or addition of hose while operating.

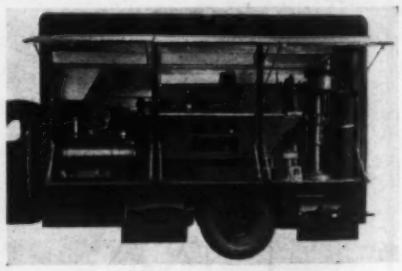
Repair Shop on Wheels

PRODUCTION OF A complete truck-mounted repair shop for use of contractors, utilities, oil companies, mines, railroads, highway departments, and all concerns operating over extended areas was announced recently by the Davey Compressor Co., Kent, Ohio.

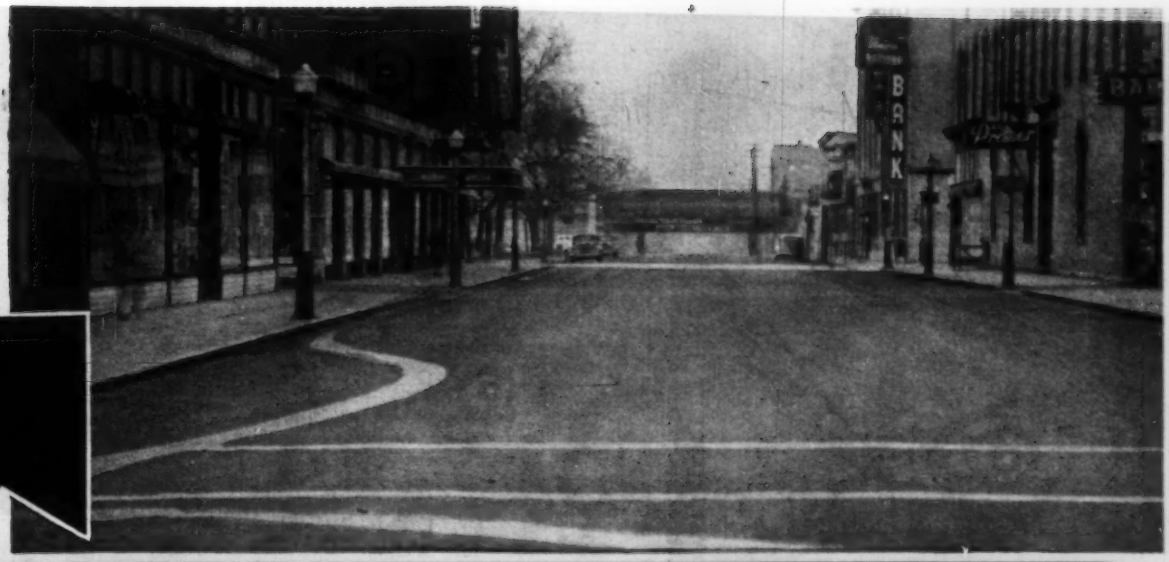
Suitable for mounting on any standard long wheel base truck, the shop assembly (known as the Davey Mobile Repair Shop) contains virtually every item of equipment needed for mechanical repair and maintenance work. Its use will eliminate the present practice of hauling broken-down machines to central shops for repairs.

While it is possible to secure almost any desired combination of equipment, the Davey Company has worked out a number of standard assemblies for the use of specific operators. For example, one assembly includes as its main units, a 60-cu ft Davey compressor, a 300-amp. Lincoln welding generator, 5-kw Westinghouse power generator, a 14-in. South Bend Lathe (with complete accessories and tools), and a drill press of 1 in. capacity.

Auxiliary accessories are the same as those found in any stationary machine shop: a blacksmith's forge; fitters' equipment; boilermaker's hand tools; a $\frac{1}{2}$-ton hoist; 2 ten-ton jacks; a hand-operated hoisting winch; plumber's tool kit; carpenter's tool kit; electrician's hand tools; 30-cu ft acetylene generator; gas welding and cutting equipment; oxygen bottles; electric welding accessories; grinder with drill grinder attachment; hand pneumatic drill, pneumatic hand grinder; 2 pneumatic riveting hammers; 2 pneumatic drills; soldering irons; emergency lights, axe, pick, saw, air hose, shovel, etc.



The truck body is replete with tool boxes and storage bins. An outside power receptacle is provided for the use of local electric current when available. There are seven inside power receptacles and five interior ceiling lights. The lower third of the sides of the truck body may be lowered to a horizontal position, providing a large amount of outside work bench space. The upper two-thirds of the body sides are raised to furnish protection against sun and rain. The body is waterproof and can be locked securely to prevent tampering or theft.



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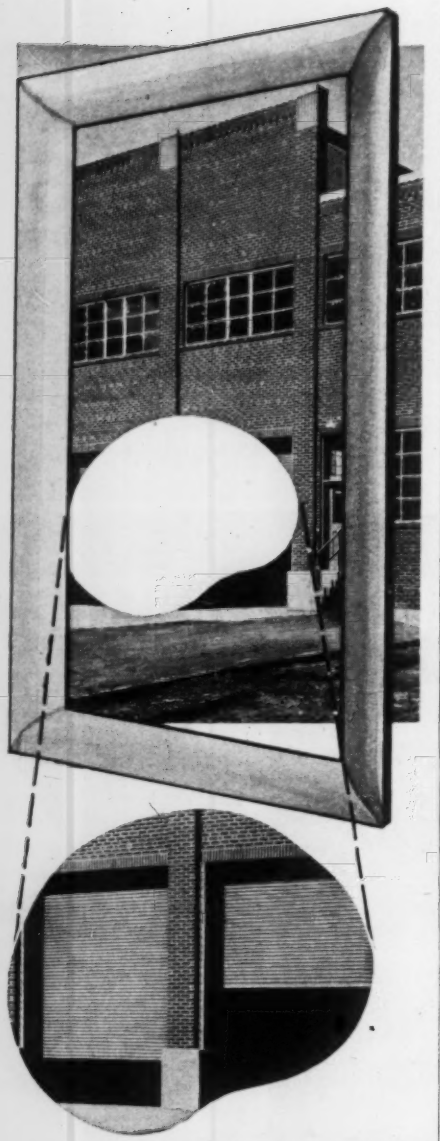
If you are located in the Middle West, a Standard Oil Asphalt Representative in your locality will be glad to discuss details of the methods and procedure followed by other highway departments now using asphalt to build up and to keep up their highway systems. Call the local Standard Oil Company (Indiana) office, or write 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE



Kinnear Rolling Doors Complete the Picture

You can be sure of fullest efficiency at every doorway when you install Kinnear Rolling Doors. Their coiling upward action saves floor and wall space. The doors remain out of the way and safe from damage when opened. All-steel construction brings extra protection and longer life. For added speed and convenience, motor operation may be incorporated, with any number of extra control stations at remote points. Write for details on Kinnear Rolling Doors.

The KINNEAR Manufacturing Company

Factories: 1080-90 Fields Ave., Columbus 16, O.
1742 Yosemite Ave., San Francisco 24, Calif.
(Offices and Agents in all Principal Cities)

Saving Ways in Doorways
KINNEAR
ROLLING DOORS

New Small Tournapull

A NEW SMALL TOURNAPULL for high-speed dirtmoving, the Model D, has been developed by R. G. LeTourneau, Inc., Peoria, Ill.

Powered by an 85 hp gasoline engine, this prime mover is equipped with the new E-4 Carryall Scraper, having a load limit of 4 tons and a struck capacity of 3.3 yd. The unit is self-loading, has 4 speeds forward, 4 reverse and travels up to 23 miles per hour.

One of the features of this Tournapull is the new electric control by individual electric motors—an operating principle which replaces conventional tractor steering and gear shift levers, and also eliminates the need of a power control unit for scraper operation. Operator steers, shifts and handles all scraper controls by buttons on the electric control panel.

The D Tournapull has a new type differential which keeps both wheels pulling at all times. On slippery going the most power is supplied to the wheel on firmest footing; neither wheel will spin independently of the other. This factor, with positive steering, which enables the operator to lock the Tournapull and Carryall into a single unit, contributes to mobility and ease of operation.

Ability to turn in its own length from a full stop makes this small, fast rig extremely maneuverable. Overall dimensions are: length 22 ft, 5 in.; height 7 ft, 4 in.; wheelbase 13 ft, 2 in.; width of cutting edge 6 ft, and weight empty 7½ tons. Based on good working conditions, average material, 60-min. operating efficiency, a single D Tournapull, self-loading and one-man operated, is capable of moving 48 yd an hour on 200 ft one-way haul; 40 yd on 800 ft haul; 33 yd on 1500 ft haul; 27 yd on 2500 ft haul; and 18 yd an hour on 5000 ft one-way haul.

New Lincoln A.-C. Welder

THE LINCOLN ELECTRIC CO., Cleveland, Ohio, announces the new "Fleet-Arc" a.-c. welder. This new welder, equipped with the "Arc Booster," is said to have many surpassing features: ease of welding, depth of penetration, range of output, economy of operation, safety, dependability, and service life. The "Arc Booster" augments the current the instant the arc is struck. The arc is started automatically the moment the electrode touches the work. This feature has been accomplished safely without the use of special high-frequency devices or higher voltage.

(Continued on page 98)

MacArthur

37 YEARS INSTALLING PILES
OF EVERY TYPE
CAST-IN-PLACE
CONCRETE
COMPOSITE
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GOLDEN-ANDERSON
design and build
over 1500
types and sizes in

automatic
VALVES
for safe protection
on any high pressure
installation

In addition to more than 1500 standard types and sizes of manual or automatic steam and water service valves — GOLDEN-ANDERSON engineers design and build special valves to meet most any difficult high or low pressure service.

Write today for descriptive, technical catalog.

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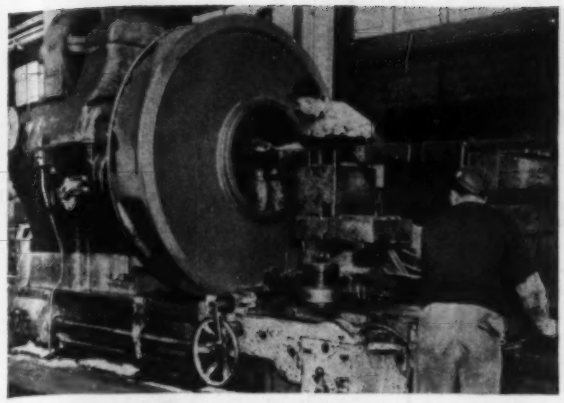
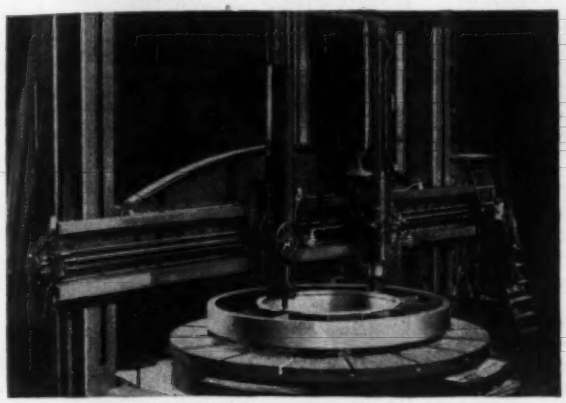
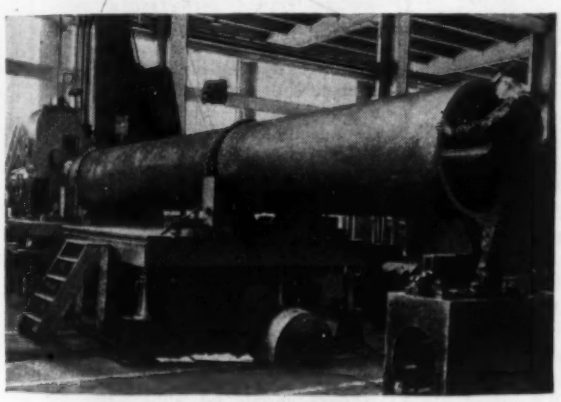
VALVE Specialty Company
PITTSBURGH 22, PA.



Cutting threads in an 88-inch dredge pump impeller. A typical "Federal" job resulting from years of experience in building dredging equipment.



Machining gear blank on vertical boring mill. Federal "know-how" is brought to bear on large and small machine parts of all types.



Boring dredge spud tube sleeve on horizontal boring mill. Modern machining techniques employed in Federal shops combine speed and efficiency.

Miscellaneous fabrication is a "Federal" specialty

In whatever industrial category your fabrication requirements may fall, "Federal" is equipped to handle them. Dredges, dredge parts, breechings, boiler casings, floating structures, heavy machine construction and fabricated assemblies, kitchen and marine galley equipment are among the varied fabrication jobs performed every day in "Federal" shops.

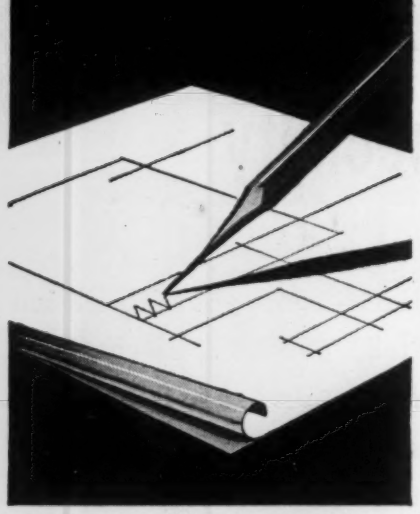
"Federal" reputation—first established in the field of shipbuilding and ship repairs—is your assurance of complete and speedy satisfaction.

FEDERAL SHIPBUILDING AND DRY DOCK COMPANY

LINCOLN HIGHWAY, KEARNY, NEW JERSEY

UNITED STATES STEEL

TRACING CLOTH
for
HARD PENCILS



● Imperial Pencil Tracing Cloth has the same superbly uniform cloth foundation and transparency as the world famous Imperial Tracing Cloth. But it is distinguished by its special dull drawing surface, on which hard pencils can be used, giving clean, sharp, opaque, non-smudging lines.

Erasures are made easily, without damage. It gives sharp, contrasting prints of the finest lines. It resists the effects of time and wear, and does not become brittle or opaque.

Imperial Pencil Tracing Cloth is right for ink drawings as well.

IMPERIAL PENCIL TRACING CLOTH

SOLD BY LEADING STATIONERY AND DRAWING MATERIAL DEALERS EVERYWHERE.

A selector switch on the front of the welder governs the amount of booster current to be used in striking the arc. This provides a complete range of striking intensity to suit requirements in the welding of thin sheets or heavy plates, making of tack welds, or in the use of various types and sizes of electrodes. Current control, continuous and self-adjusting, is provided by the rotating reactor control, which affords fast setting throughout the wide range of the welder. The amperage is indicated on a calibrated dial on the face of the welder. The reactor current control is held in position by cone brakes and actuated by a self-cleaning chain drive.

Thermostatic control, which opens the magnetic starter when overloaded, provides protection for the operator, permitting sustained welding at high current values and use under abnormal conditions without damage from overheating.

A higher power factor and a reduction of condenser requirements and less shock to the operator has been gained through the use of the "Fleet-Arc's" lower open-circuit voltage. In reducing the amount of condensers required, the idle input current has been decreased considerably. The "Fleet-Arc" a.-c. welder, manufactured in 200, 300, and 500 amperage range, has both frame and housing of all-welded construction.

Tamping Rollers

GIANT TAMPERS THAT are said to produce earth compaction of 800 psi. are a new addition to the construction equipment manufactured by the Wm. Bros Boiler and Manufacturing Co., Minneapolis, Minn. To meet a range of compaction requirements, this new tamper applies 335 psi. when empty and can be used at any weight up to 800 lb. maximum. The new Bros tamper, Model G-2, has been designed to meet compaction requirements of such varied jobs as earth dams, airport runways, and highways. The average pressure on each foot varies as follows: empty drums, 2,350 lbs; water filled drums, 4,000 lbs; and wet and sand filled drums, 5,660 lbs.

The oscillating-type roller consists of two 76-in. drums, designed around a "full-floating" pole. This "full-floating" principle allows for full individual drum oscillation and with either angular or parallel lifting, eliminating all strains. For example, one drum may float upward or downward four inches independently of the other one with both on a parallel plane. The Bros G-2 drums are surrounded by a box type frame, centered on the drum axle to prevent off-center loads but the pole is so mounted on each as to produce the straight line pull with the tractor drawbar. Each roller has a stationary welded axle, supported on each end with self-aligning ball bearings, dust and dirt sealed and pressure-lubricated. Drum cleaner teeth on the G-2 Tamper are constructed of heavy duty channel steel, properly reinforced and adjustable for take-up. Due to wear, these cleaner teeth working off a tangental line from the outside diameter of the drum can be adjusted for wear. This permits cleaning with a minimum of strain.

M H

HYDRANTS & VALVES

Pipe Line Accessories for Water Works and Sewage Works

Write for Catalog No. 34

VALVES: A.W.W.A. type iron body, bronze mounted with double-disc parallel seat or solid wedge type. Non-rising stem, outside screw and yoke, or with sliding stem and lever. Also furnished hydraulically operated. Square bottom type operates in any position. All rugged and dependable, made of best material with highest quality workmanship.

HYDRANTS: Standard A. W. W. A. type approved by Underwriters and Factory Mutuals. SPECIAL TRAFFIC MODEL is designed to yield at ground line under impact, repair being simply renewal of breakable bolts and breakable coupling on stem.

M & H PRODUCTS INCLUDE

FIRE HYDRANTS	SHEAR GATES
GATE VALVES	MUD VALVES
TAPPING VALVES	VALVE BOXES
WALL CASTINGS	FLAP VALVES
SPECIAL CASTINGS	SLUDGE SHOES
TAPPING SLEEVES	FLANGE AND FLARE FITTINGS
CHECK VALVES	FLANGED FITTINGS
FLOOR STANDS	B & S FITTINGS
EXTENSION STEMS	CUTTING-IN TEES

M&H VALVE AND FITTINGS COMPANY

ANNISTON, ALABAMA

Shovel, Dragline and Crane

MARION POWER SHOVEL COMPANY of Marion, Ohio presents the Marion 93-M, a heavy-duty, all-purpose shovel, dragline, clamshell and crane. It is a full-rated $2^1/_2$ cu. yd. machine designed for mining, quarrying and large-scale construction projects, particularly those involving ore and rock. Features of the new machine include Marion air control ease of convertibility to dragline, clamshell and crane service, ease of preparation for railroad shipment, and ample power for heavy-duty service.

Shovel front-end equipment includes an all-welded, rounded-edge, box section boom, twin welded full box section dipper handles and a heavy duty manganese-steel-front dipper with inserted socket-type dipper teeth.

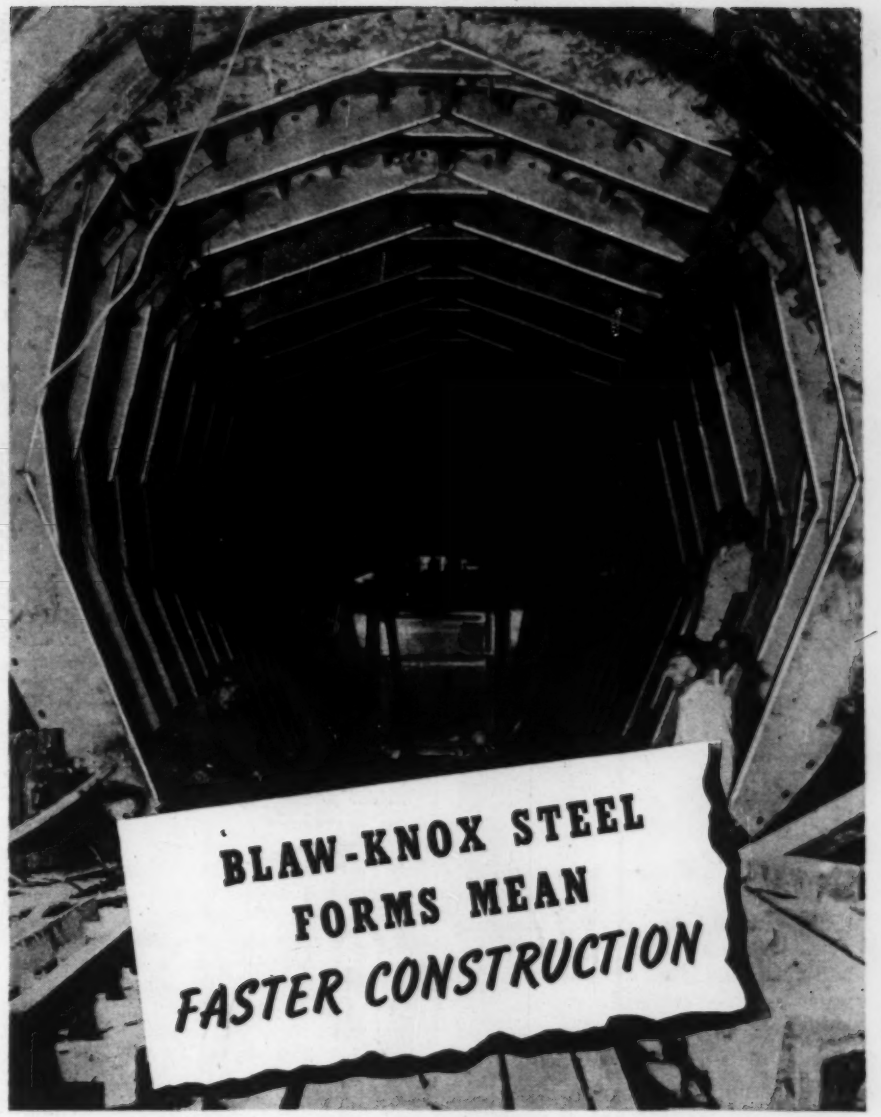
For dragline or clamshell service, varying boom lengths and bucket combinations are available. A live boom hoist is standard equipment, making the machine particularly adaptable for crane service.

New Metal Coping

NEW ON THE building market, simple in construction, and easy to handle is the Goodwin Lifetime Metal Coping states the Overly Manufacturing Co., Greensburg, Pa. Among the many advantages claimed for this prefabricated metal coping are that it can be quickly assembled and installed, is light in weight, needs no caulking or re-sealing, and it requires no special tools for erection. Goodwin Lifetime Metal Coping is produced in a series of standard sizes and edgings that will fit most coping jobs. At present, production is concentrated on the $12^1/_2$ and $8^1/_2$ in. widths for standard walls.

Four pieces of metal form the basic parts of this metal coping, all of them prefabricated, and supplied in standard lengths. Installation of the coping begins with the anchor bolts which are set in the mortar when the two top rows of bricks are laid in a new wall. A formed metal channel fastens to this anchor bolt and the longitudinal sheets with crimped edges hood over the gutter bar. Over this joint slides the safety cover, held in place with two screws. This construction forms a tight joint with ample room for expansion and contraction.

The Overly-Goodwin Metal Coping is being fabricated in many of the corrosion-resistant metals: aluminum, copper, monel, stainless steel, etc. Further details in a bulletin, from the manufacturer.



Sound engineering, rugged construction and a reputation for smooth practical performance is the unbeatable combination which Blaw-Knox steel forms give to contractors on big jobs.

Whether the job calls for heavy forms on tunnels and conduits, on low retaining walls or high multiple arch dams, Blaw-Knox forms assemble and strip readily, save time and manpower, and generally speed and improve the work.

BLAW-KNOX DIVISION
OF BLAW-KNOX COMPANY
2060 Farmers Bank Bldg.
Pittsburgh 22, Pa.

SEND for Catalog No. 2035 on steel forms for heavy construction.

BLAW-KNOX
STEEL FORMS

A high strength to weight ratio ($\frac{S}{W}$) is not only good engineering but has special advantages in tunneling work. ARMCO Tunnel Liner Plates are designed for utmost strength with the least possible weight.

This means that one unskilled workman can carry, hold and bolt into place an Armco liner section. Only a structural wrench is needed. Labor costs are low and the job goes fast. Less bulk also means less excavation, and storage requirements are smaller. With ARMCO Plates you buy no excess metal, and this keeps job costs down.

You'll find ARMCO Liner Plates the simplest, most inexpensive way you ever saw to install conduits, sewers and similar structures. You avoid the hazards and inconvenience of open trenching and business above ground continues as usual. Use ARMCO Tunnel Liner Plates on that next job to "hole through" ahead of schedule and under the estimate. Write for data. Armco Drainage & Metal Products, Inc., 1195 Curtis St., Middletown, Ohio. Offices in Principal Cities.

ARMCO
TUNNEL LINER PLATES

Literature Available

COLOR DYNAMICS—How scientific use of the energy in color is currently employed in the nation's plants and factories to increase overall efficiency is shown in a new full-color, 32-page booklet now being distributed by the Pittsburgh Plate Glass Company, Department NIB, Public Relations Dept., 632 Duquesne Way, Pittsburgh, Pa. The booklet demonstrates how industrial officials can promote continuity of employment, improve efficiency of operation, and maintain quality of production. It outlines scientific facts about color including the use of color on machinery and equipment, on walls and ceilings, and on floors, aisles, and mobile equipment with emphasis on color for safety.

ENGINE BROCHURE—A new 8-page brochure describing their 2-cycle Series 1200 diecast industrial gasoline engines, from $2\frac{1}{2}$ to 4 hp, is announced by McCulloch Motors Corporation, 6101 W. Century Blvd., Los Angeles 45, Calif. Details on standard engines now in mass production are given, as well as information on special engines which the company is prepared to design and mass-produce for a wide variety of customer applications in the transportation, marine, implement, aircraft auxiliary, and other fields.

HYDRAULIC EQUIPMENT—New Blackhawk P 46 Porto-Power Catalog and price schedule describes uses of all-directional Porto-Power hydraulic jack equipment and pipe benders for maintenance, production and laboratory work; and New Blackhawk J-46 Hydraulic Catalog and price schedule lists hand jacks up to 100-ton capacities, gage-equipped jacks and wheeled floor jacks. Write Blackhawk Mfg. Co., Catalog Department, Milwaukee 1, Wis.

PARLON—Hercules Powder Company, Wilmington, Del., has issued a new technical book on Parlon, the Hercules chlorinated rubber product used as a base in paints for concrete and other surfaces exposed to action of chemicals, gases, moisture, mold growths, and other destructive agents. The book contains many new formulations as well as the results of long-time exposure tests of Parlon finishes. It is divided into two sections—properties and uses. The finishes discussed are alkyd enamels, finishes for alkaline surfaces, paints resistant to chemicals, varnishes, traffic paints, furniture finishes, marine finishes, and emulsion paints.

VALVES—Seven types of valves—examples of the more than 1,500 standard types and sizes made by Golden-Anderson Valve Specialty Company, Pittsburgh, Pa.—are described and illustrated in a new 4-page bulletin. Included are Golden-Anderson water pressure reducing valves single acting standard altitude valves, integral pilot type cold water float valves, railroad track pan float valves, water strainers, and counter-balanced railroad standpipe valves and water columns.

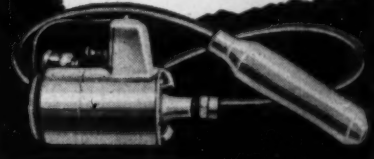
CUT CONCRETE COSTS!

High Speed Viber-ation increases profits, improves work, saves delay.

VIBER
Concrete Vibrators

Experience on hundreds of big concrete jobs proves it costs less to vibrate concrete with High Speed VIBERS—9,500 RPM. in concrete.

Send for catalog.



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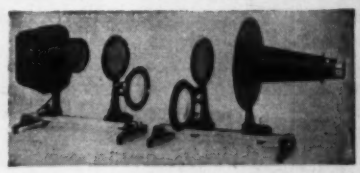
ORIGINATORS OF INTERNAL CONCRETE VIBRATION

Polaroid* . . .
Photoelastic
Polariscope
for Stress Determination



To the machine designer, photoelastic stress analysis is not only of value in the verification of calculations based on theoretical solutions, but also in the solution of problems where theoretical analysis is not available. Where weight and space must be conserved actual stress distribution is more important than stress indicated by theoretical analysis.

In the new model polariscope of $4\frac{1}{4}$" clear aperture, the parallel beam is collected by a rear element and condensed through a three component lens of the Cooke system. In the new larger unit ($8\frac{1}{4}$" aperture) a four component lens of the Omnar system is used. *The image is sharp throughout the field, free of aberration, astigmatism and distortion.*

Literature of new model polariscope now available

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